



Scanning -- Shortwave -- Satellites -- Ham Radio -- Computers

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Monitoring Times

From Spark Gap to Digital

German radio's colorful past,
DW's 50th, and the digital future

- ✓ Digital Radio Mondiale
- ✓ HiFi for SW Radio
- The EH Antenna -
Hit or Hype?
- US Army Aviation on HF



AR8600 Mark II

Competitors Could Not Surpass the AR8600

– So We Did!



It's a new world we now monitor.

It's no wonder that many professionals, including government, newsrooms, laboratories, military users and more rely upon AOR, the **Authority On Radio™**.

AOR is proud to introduce the AR8600 Mark II. It's hard to believe there could be a better wide-range receiver than the original AR8600 but here's what we've done:

We added more coverage, now receiving from 100 KHz ~ 3 GHz*. *We improved the front end, and added improved receive audio response.* We also added display illumination control and we're working on an optional NTSC video module.

From the improved ultra-stable TCXO to the availability of Collins® Mechanical Filters and optional card slots, the AR 8600 Mark II sets new performance standards for wide-range receivers. Our relentless pursuit of excellence is what makes AOR *the Serious Choice in Advanced Technology Receivers.™*

- Improved ultra-stable Temperature Compensated Crystal Oscillator (TCXO)
- Expanded tuning range: 100 KHz ~ 3 GHz *
- Receive Modes: WFM, NFM, SFM, WAM, NAM, USB, LSB, CW. Optional NTSC Video card available soon.
- New front end RF stages for superior sensitivity and selectivity.
- 2 VFOs (A/B)
- 1000 memory channels (20 banks X 50 memories/bank)
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- Up to 37 channels/second search rate
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- Accommodation for Collins® Mechanical Filters
- RS-232C port
- Download free control software from www.aorusa.com
- 10.7 MHz IF output (can be used with SDU 5500 Spectrum Display Unit or for secondary signal processing.)
- 12 VDC operation
- BNC antenna connection

*Cellular blocked. Unblocked version available to authorized users, documentation required. Specifications subject to change without notice or obligation.

"A shock to the system." *

The new WINRADIO G303i receives rave reviews. And shortwave radios will never be the same.

* Shortwave Magazine, February 2003

The exciting WINRADIO G303i Software-Defined Shortwave Receiver is now available.

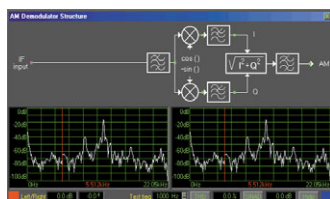
Why is it *Software-Defined*? Because the entire last intermediate frequency stage and all-mode demodulator are implemented entirely in signal-processing software running on a personal computer. This brings about significant advantages: performance, flexibility, configurability, reliability and convenience. There is also reduced risk of obsolescence, as new demodulators for new types of modulation are as easy to add as inserting a CD ROM into a PC drive.

The receiver comes on a PCI card and installs in minutes. Just plug the card in, connect its output to your PC sound card, install the supplied software, and let the world's most innovative shortwave receiver surprise you with its performance and amazing new features.



In addition to the flexible and friendly user interface with numerous functions and facilities not normally available on a conventional receiver, the WINRADIO G303i Software-Defined Shortwave Receiver excels particularly with the ability of its demodulators: While the Standard Demodulator provides the performance of a highly respectable shortwave receiver, including synchronous AM demodulation and a real-time spectrum scope, the optional Professional Demodulator offers even more: continuous selectivity setting (in 1 Hz increments), interactive block diagrams with additional real-time audio spectrum scopes, built-in performance test facilities, user adjustable filters, and many other features. Additional demodulator types are planned as further options, including a DRM (digital radio) demodulator.

Just when you thought that there is nothing in shortwave that can surprise you anymore, here comes the new WINRADIO G303i. It *will* impress you. We guarantee it.



The G303i control panel includes many features such as a real-time spectrum analyzer, numerous tuning and scanning options, highly accurate S-meter showing signal strength in various units, sweeping spectrum scope and powerful memory facilities.

The optional Professional Demodulator expands the receiver capabilities yet further by introducing numerous innovative features, world-first for this type of radio, such as variable filter bandwidth adjustment and interactive block diagrams.

Specifications

- Frequency range 9kHz to 30MHz
- Tuning resolution 1Hz
- Modes AM, AMN, AMS, USB, LSB, CW, FM3, FM6, FMN
- Sensitivity 0.3µV (AM, 80% modulation, 10dB S/N)

System Requirements

- IBM PC compatible (CPU 500MHz or higher, PCI slot)
- Sound Blaster 16 (or compatible sound card)
- Windows 98/ME/NT/2000/XP

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Check out the special introductory price of the Professional Demodulator option which includes the following additional features:

- Variable IF bandwidth (1Hz to 15kHz)
- ISB and DSB modes
- Variable filter length (selectivity) adjustment
- Interactive demodulator structures
- Vector voltmeter, THD and SINAD meter

The WR-G303i receiver was reviewed by the Shortwave Magazine (Feb. 2003), Monitoring Times (March 2003) and Radio & Communications (Feb. 2003), with impressive conclusions. Here are only a few highlights of the reviews:

On spurious signal rejection: "As far as I can remember I have never found any receiver, analogue or digital, which had such cleanliness, and the WR-G303i has set a new standard for others to emulate." [SWM]

On sensitivity: "... higher than necessary in a receiver of its type...". [SWM] • "Much of this sensitivity is contributed by the low phase noise of the oscillator, typically -148dBc/Hz @ 100 kHz. Clearly this radio meets or exceeds the competition head on..." • "With a sharp filter selection using the Professional Demodulator, CW signals as weak as 30nV (0.03 uV) are distinct." [MT] • "In short, the performance is superb. The sensitivity and selectivity surpassed my expectation, and there was no sight of intermod even in the presence of strong stations at night time." [R&C]

On variable IF bandwidth: "... a very useful feature and allows you to exactly match the filter bandwidth to the incoming signal ... once experienced never to be forgotten." [SWM] • "... an astounding feature to hear when invoked!" [MT] • The experience of being able to finely tune selectivity to suit a particular signal you are listening to is truly incredible, especially if you have been used to having just a few fixed bandwidths on your old radio." [R&C]

The verdict: "If I had to choose between a Collins 95S-1 and the WR-G303i (ignoring the obvious fact that the 95S-1 tunes to 2 GHz), I would take the WR-G303i." [SWM] • "This receiver is a gadget-owner's dream! But it isn't fantasy; for the first time in consumer technology, the shortwave listener can tailor his receiver to his own requirements, independent of factory-set parameters." [MT] • "The WINRADIO WR-G303 receiver, in addition to being an excellent receiver on its own right, has a certain exciting feeling about it. Perhaps this is because of the promise of a change of an entire paradigm which makes a difference between just another run-of-the-mill product and a truly innovative cult product, sparking an entirely new following." [R&C]

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Cover Story

Radio in Germany From Spark Gap to Digital

By Manosij Guha

2003 is a landmark year for Deutsche Welle: Not only will it celebrate 50 years of broadcasting in May, but in June DW will be the very first broadcaster to begin regular transmissions over shortwave using the new digital mode, DRM. Somehow, this seems quite appropriate from the country that gave us Heinrich Hertz and the spark gap transmitter.

Our author was on site at DW's underground monitoring station at Bockhacken to witness reception of the December digital test transmission. He walks us through the evolution of short-wave broadcasting in Germany, from the earliest station at Nauen, through World War II and Cold War broadcasting from two Germanies, to DW's gradual move from its tower in Cologne to a new home in Bonn. Story starts on page 10.

On our Cover: Deutsche Welle's Cologne headquarters, photographed by Manosij Guha.

C O N T E N T S

Digital Radio Mondiale 16

By D Prabakaran

Digital Radio Mondiale, or DRM for short, is the new global standard which intends to provide FM-quality sound on the interference-prone "AM bands." Radio hobbyists have watched with anticipation along with anxiety as digital HF broadcasting came ever closer to reality, but few details have been available on what DRM is and what it will mean to DXers. Now that digital broadcasts are set to begin – first by Deutsche Welle with others soon to follow – information and equipment are beginning to emerge.

The author describes the goals of digital broadcasting and details of how the system works to meet those requirements. Then he gets to the nitty-gritty of how transmitters and receivers can be modified to accommodate the new mode.

To prove that you, too, can soon be receiving DRM signals, the article includes a sidebar by Lee Reynolds, one of the first US hobbyists to decode an over-the-air DRM transmission.

The EH Antenna 22

By Bill Prudhomme

The inventor of the EH antenna claims that in the future, all antennas will be EH antennas – a bold claim, since most of us have never even heard of it! The author sets out to discover what it is, how it works, and whether EH stands for Extreme Hype or Exceptional Hit. None of the answers are conclusive, but why not join the experts? Build one and test the theory for yourself!



Tales from the Underground:

About 70 kilometers up the autobahn from Cologne, in the idyllic surroundings of Bergiches Land, cows graze the pastures quite oblivious to the goings-on in the Deutsche Welle's Receiving and Measuring Station in Bockhacken, which is built like a bunker. Inside this underground facility, stacked high in this monitor's haven are ultra-sophisticated listening and measuring equipment from Rhode and Schwartz besides other specialized ones home-brewed DW's own engineers.

Replete with remote receivers and direction finders this automated facility is the nerve center of monitoring all DW broadcasts, be it radio, television or satellite. Above ground, the only tell-tale signs are the log periodic antennas enclosed by a rustic fence and leading to a gate. The dish antenna with the DW logo is of course a dead giveaway.



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Reviews:

If you're one of those folks who are lucky enough to own an outdoor antenna tower or mast, you know that swapping antennas can still be a chore. **Talon Creative** has a "creative" antenna boom that not only accommodates multiple antennas, but can be used with magnetic mount antennas for really quick change-out (see page 85).

The **GRE Super Amplifier** is intended to boost signals from the small antenna on your handheld scanner, but Bob Parnass can't resist testing it across the board, even with an outdoor antenna. He also brags on the **OptiVISOR** binocular magnifier for working with tiny circuitry (see p.78).

Last month, John Catalano explored software to aid in reception of the planet Jupiter. Now he looks at appropriate radio and antenna choices, and reviews **Radio-SkyPipe** software which will help you analyze your results and compare them to reception from other receivers round the world (see p.80).

MT's gadget guy has at last found a flashlight worthy of his emergency kit – **C Crane's** series of **LED flashlights** will provide remarkable, reliable light any time you need it (see p.86). Last but not least, Lawrence Harris updates weather satellite enthusiasts on the latest version of **WXTOIMG** (WXSAT to Imaging) software (see p.87).

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FCC Authorizes GPS-Enhanced FRS Transceivers

In an order released February 10th, the FCC has authorized the manufacture, sale and use of Family Radio Service units that have the capability to determine where other FRS users are located.

In 1996, the FCC established the FRS as a very short range, two-way voice personal radio service. The objective was to fill a need for short distance, two-way personal communications among small groups of persons, including families, with minimal regulation.

The service, which does not require licensing, shares two small frequency bands in the 462 and 467 MHz range with the General Mobile Radio Service (GMRS). FRS channels 1-7 are also GMRS frequencies and FRS channels 8-14 are sandwiched in between other GMRS frequencies. The current FRS rules authorize only two-way voice communications. One-way transmissions are permitted only for emergency messages or to establish two-way communications.

On June 22, 2000, Garmin International, Inc., (of Olathe, KS) a leading manufacturer of Global Positioning System-enabled consumer electronic devices, requested an FCC rule waiver to allow it to design and market inexpensive FRS transceivers capable of transmitting GPS location information on FRS channels.

The GPS is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use.

Garmin's request, granted three months later, permitted the firm to make FRS radios that allowed users to transmit GPS location information using a burst of FM digital data of not more than one second.

♦ GPS okayed for FRS

On December 26, 2000, Garmin followed the waiver request up with a formal Petition for Rulemaking, (assigned file number RM- 10070) seeking to make the authorization permanent. Specifically, Garmin asked that the FRS rules be amended to permit inexpensive, handheld FRS transceivers capable of both transmitting GPS location information on FRS frequencies and graphically displaying the location information on a radio.

In support of its Petition, Garmin noted it is now possible to provide a low cost handheld de-

vice capable of providing this information to the public with an accuracy of ten meters due to the removal of the so-called "Selective Availability" from the GPS signal on May 2, 2000. "Selective Availability" was the intentional degradation of the GPS signal to an accuracy of 100 meters.

The FCC agreed that adding GPS capability to FRS units would provide a significant enhancement that the public could use to locate lost or injured family members or members of groups. On December 20, 2001, the FCC proposed to amend the rules to allow FRS units to transmit GPS location information and text messages over FRS channels. (NPRM WT Docket No. 01-339.) Comments from the public were due February 13, 2002, reply comments: February 28, 2002.

"I believe that by removing prohibitions on FRS units' ability to transmit location information, their usefulness will increase to consumers. Users will now be able to locate family members or members of groups, which is invaluable if someone is lost or injured. By allowing our rules to accommodate such new technological advancements and by encouraging innovation by manufacturers, consumers benefit from the latest technological advancements."

-FCC Commissioner Kathleen Q. Abernathy

♦ Comments generally favorable

Comments were filed by Garmin International, Inc., the Northern California GMRS Users Group (NCGUG); the Personal Radio Steering Group, Inc. (PRSG is headed up by Corwin D. Moore, Jr. WB8UPM, Ann Arbor, MI), Stewart Teaze (N0MH5, Murrieta, CA) and XM Radio, a satellite radio broadcaster. Reply comments were filed by Garmin, William C. Houlne (WB6BNQ, National City, CA), NCGUG and PRSG.

The commenters generally supported permitting limited non-voice FRS communications. Some proposed additional features such as permitting other short data communications applications, revising the FRS definition, restricting store-and-forward packet operations and requiring FRS units to have pre-set unique identification codes.

The FCC noted that since the FRS was initially authorized, text-messaging has become an increasingly common consumer activity, by way of internet instant messaging and text-enabled wireless telephones. "We believe that allowing incorporation of this function into FRS units will enhance their usefulness to consumers," FCC said.

The agency said that it would continue its rule prohibiting FRS interconnections to the public telephone system, however, to reduce congestion, and that digital data transmissions must be limited to no more than one second out of a ten-second period.

♦ How It Works

FRS units will be permitted to determine the location of other FRS units within a given operating area. Polling individual FRS units will be optional, so manufacturers will be able to provide units without that feature to users who do not want it, or units on which the user can enable or disable the feature at will.

Garmin proposed to graphically display the GPS location information transmitted by another FRS unit and the FCC is allowing this feature, but declined to impose a GPS data transmission standard.

"In summary, we believe that the public interest will be served by permitting FRS units to transmit location information and FRS user generated text messages. Therefore, in this Report and Order, we amend our Rules to allow a FRS unit to transmit a digital data emission and communications containing FRS user generated text and location information.

These rule changes will enhance the usefulness of the FRS as a service that provides an affordable and convenient means of direct, short-range two-way voice communications among small groups of persons, with minimal regulation," FCC said.

The new rules become effective thirty days after publication of the Report and Order in the Federal Register, about mid-March.

In Appreciation

This is the final *Washington Whispers* column, which has been running in *MT* since January 1998. Fred Maia will continue to keep us up-to-date with developments through his ham radio *W5YI Report*. We are most grateful for Fred's thorough research and wide interest in new technologies and amateur radio.

In its place, *Monitoring Times* will introduce a new column on radio and law. Written by Indianapolis criminal defense attorney Jorge Rodriguez, the column will cover the mounting complexities of staying legal in the radio listening hobby. Readers are invited to submit their own stories and topics of concern to Mr. Rodriguez at JR@INDYLAWYER.COM or 7399 N. Shadeland Ave., #235 Indianapolis, IN 46250.

GRUNDIG SHORTWAVE

Leaders in Their Class

*"Outstanding Performance...
Unbeatable Audio Quality...
Unbeatable Price..."*

Lawrence Magne—Editor in Chief, Passport to World Band Radio.

The LCD Big! Bold! Brightly Illuminated 6" by 3 1/2".

Liquid Crystal Display shows all important data: Frequency, Meter band, Memory position, Time, LSB/USB, Synchronous Detector and more.

The Signal Strength Meter Elegant in its traditional Analog design, like the gauges in the world's finest sports cars. Large, Well Lit. Easy to read.

The Frequency Coverage Longwave, AM and shortwave: continuous 100-30,000 KHz. FM: 87-108 MHz VHF Aircraft Band: 118-137 MHz.

The Tuning Controls

- For the traditionalist: a smooth, precise tuning knob, produces no audio muting during use. Ultra fine-tuning of 50Hz on LSB/USB, 100Hz in SW, AM and Aircraft Band and 20 KHz in FM.

- For Fixed-step Tuning: Big, responsive Up/Down tuning buttons.

- For direct frequency entry: a responsive, intuitive numeric keypad.

The Operational Controls Knobs where you want them; Buttons where they make sense.

The best combination of traditional and high-tech controls.

The Sound Legendary Grundig Audio Fidelity with separate bass and treble controls, big sound from its powerful speaker and FM-stereo with the included high quality headphones.

The Many Features 70 user-programmable memories, Two 24 hour format clocks, Two ON/OFF sleep timers, Massive, built-in telescopic antenna, Connectors for external antennas – SW, AM, FM and VHF Aircraft Band, Line-out, headphone and external speaker jacks.

Size: 20.5" L x 9" H x 8" W

Weight: 14.50 lbs.



Satellit 800



Yacht Boy 300PE AM/FM/SW Radio

Power and Performance with Affordability

Designed for the traveller, the titanium look digital AM/FM/SW radio provides incredible power and performance for an incredibly low price! Packed with features, including 3 AA batteries, AC adapter, earphones, supplementary Antenna and carrying case!

State-of-the-art features include:

Digital tuning with 24 user-programmable memory presets, 13 SW Bands (2.30-7.80 MHz; 9.10-26.10 MHz), Illuminated multi-function LCD display screen, AM/FM stereo via earphones, Clock, alarm and 10 to 90 minute sleep timer, Digital tuning display, Direct frequency entry, DX/ local selector, Titanium look finish, External antenna jack, Dynamic micro speaker, Earphone jack, Telescopic antenna.

Size: 5.75" L x 3.5" H x 1.25" W Weight: 9.92 oz.



Yacht Boy 400PE AM/FM/SW Radio

Most powerful and compact portable

The Big Breakthrough! Power, performance, and design have reached new heights! The Grundig 400 Professional Edition with its sleek titanium look is packed with features like no other compact radio in the world. **Pinpoint Accuracy!** The Grundig 400PE does it all: pulls in AM, FM, FM-Stereo, every shortwave band (even aviation and ship-to-shore)—all with lock-on digital precision. **Ultimate Features!** Auto tuning! The Grundig 400PE has auto tuning on shortwave that stops at every signal and lets you listen. With the exceptional sensitivity of the 400PE, you can use the auto tune to catch even the weakest of signals. Incredible timing features! The Grundig 400PE can send you to sleep listening to your favorite music. You can set the alarm to wake up to music or the morning traffic report, then switch to BBC shortwave for the world news. The choice is yours! **Powerful Memory!** Described as a smart radio with 40 memory positions, the Grundig 400PE remembers your favorites—even if you don't!

Size: 7.75" L x 4.5" H x 1.5" W

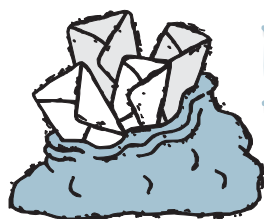
Weight: 1 lb. 5 oz.

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for the traveler in you!

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LETTERS TO THE EDITOR

We should have said ...

"The Feb 2003 issue, p. 8, *Communications* item 'Frequency Matters' does not make any sense. The item says ... 'The pilot became disoriented and tuned his radio to a frequency that called for navigational help. ... he had called on a frequency that indicates there is a hijacker on board.'

"Voice calls regarding hijackers are made on the com freq you are using or on the universal emergency freq 121.5. Your item almost certainly should have said that the pilot intended to reset the SQUAWK CODE on his TRANSPONDER from that which indicates the aircraft is operating under visual flight rules, 1200, to the transponder code which signals the aircraft has an emergency, 7700. There are several other codes in the 7000 series which indicate different types of emergencies, e.g., radio failure, or hijacker on board. Most probably the item should say that the pilot inadvertently reset the code on the transponder from 1200 (or whatever code had been assigned to him by ATC) to the 7000 series code for hijack rather than 7700 which denotes an in-flight emergency.

"The transponder in an aircraft is a discreet address beacon which is interrogated by ATC radar and responds with a discreetly coded response which is peculiar to that aircraft and which is assigned by ATC. The instruction to a pilot from ATC will be, e.g., 'Cessna N12345, squawk 3456.' The pilot then sets the transponder to 3456 and his aircraft is then displayed on ATC radar as a target with a data block unique to that aircraft giving aircraft speed, etc. In Mode C the transponder also sends to ATC the aircraft's altitude, which is displayed in the data block."

- Bob Coley

Bob, I think you're absolutely right about the real events in the case. Without time to research the matter, I simply repeated the item as it was reported, but it didn't make much sense to me, either! Thanks for coming up with a more logical explanation.

Bob also mentions that the FAA codes may be available but are probably better off not being published, given the potential for REAL hijackings. - rb

This reader really cooks!

"Greetings from Salem, OR! I recently purchased the 2001 and 2002 CD ROM *MT Anthologies*. On the 2002 anthology disc, I was able to print out the index for 2002. This greatly helps me in locating the specific information I am looking for.

"To tell you a little about myself: I am new to shortwave listening, having purchased a Sangean ATS909 within the past month. I have been a long-time AM Band DXer - though it's been a good number of years since I've done that.

"During the week I am the Director of

Marketing for Traeger Industries, Mt. Angel, OR. We manufacture wood pellet-fired barbecues. On Saturdays, I am the host of *Cooking Outdoors With Mr. Barbecue*, which is broadcast over NewsRadio 750 KXL, Portland. (You can hear the show via Internet at <http://www.kxl.com>). My show resumes Saturday, February 8th. It airs between Noon-1:00pm Pacific Time.

- Bruce Bjorkman, "Cooking Outdoors With Mr. Barbecue"

Dear Bruce - I'm glad you are enjoying the *MT* anthologies. I, too, rely on the indexes as heavily as the Search button to point me in the right direction for a previous article. The 2001 *Anthology* did not include the index; however, full indexes are available for the past several years on the *MT* home page (<http://www.monitoringtimes.com>) - rb

Quantum QX rave

"I can't begin to say enough good things about the Quantum QX [ferrite rod antenna covering 530-2000 kHz]. It is fantastic and amazes me every time I use it. This is an antenna that will be surprising me for years. In case you aren't familiar with it, it has a rotating rod head that tilts almost 90 degrees. It uses a regeneration method combined with passband narrowing. It works and it works great! The link to info on the antenna from RadioPlus+ is: <http://www.dx-tools.com/PRODUCTS.htm> or radioplus@bellsouth.net.

"I enjoy reading the *Below 500 kHz* column every month."

- Barry Williams, Auburn, AL

Radio in my life

Vern Modeland, WJOJ, is a full-spectrum radio hobbyist featured in this month's *Scanning Report* column on page 28. Vern was one of five winners in the 1999 essay contest celebrating Ontario DX Association's 25th anniversary. Here's his essay on shortwave listening, shortened slightly and reprinted with permission.

Radio in My Life

By Vern Modeland

The Radio, a magnificent sturdy Philco floor model, sat proudly, prominently and with a honey-colored sheen in the living room of our home in the 1930s. That magical radio remains fixed in living sound and color among my earliest recollections. From its speaker, while I played on the carpet before it as a small child, came the sounds of *Stella Dallas* and *Fibber McGee and Molly*, *Grand Central Station*, *Lux Presents Hollywood* and Joe Louis versus Max Schmelling and *The Lone Ranger* with Tonto.

Then, about when I was just old enough to comprehend, my father explained patiently that between the squeals and static, we were listen-

ing to Adolph Hitler speak from Berlin, a far away place. I only remember Hitler as screaming in an unintelligible tongue ideas that were equally unintelligible to a small boy in Iowa. I heard a somber Winston Churchill on the BBC, too. And Edward R. Murrow reporting from war-torn London. It was surely a wonder. It sent me to my maps to see where these places were.

As I grew older, my father taught me an appreciation of the miracle of radio. And he gave me a book to read that I would later inherit. It is at my side now as I type. It is called *Modern Radio Reception*, written by Charles R. Leutz, the 1928 edition, the seventh revision as the new thing called radio sped forward and the Transoceanic took its place along side Grebe Synchrophase and Silver Ghost and Phantom as state of the art.

In my pre-teens, I began trying my own hand at building antennas. I also became a regular visitor to the Boone, Iowa, newsstand to get each new issue of *White's Radio Log*. That, and my little Airline five-tube superheterodyne, shared space in a flashlight's beam beneath the covers when a youngster was thought to be fast asleep. We picked out Steve Allen doing his live routines from nightclubs in New York, (or was it Los Angeles?). We heard police calls from Ohio when the police radio band was still at 1600 Kc - not kHz, Kc as in Kilocycles. We logged KDKA, WLW, WOW, WWL, KOA, KSL and even, maybe, Hawaii!

That little Airline got stripped to its chassis and became a low-power transmitter, loop modulated with a war-surplus carbon hand microphone, when I got to senior high school and, of course, took the elective course simply called Radio. ...

I found my way into a career in broadcasting, starting with my home town station, KWBG, Boone, Iowa and ending up at WHO AM-FM-TV, Des Moines, Iowa, the radio "Clear Channel Voice of the Middle West," with a heritage of its own that dated back to the mid '20s and an owner who uniquely understood the power of the medium. His name was B.J. Palmer. He wrote a book about how to use it called *Radio Salesmanship*. I still have my copy.

On WHO Radio, I found myself pinching myself those weekday mornings when I followed NBC's popular Alex Dryer with my very own broadcast of the state news at 7:05 a.m. While at WHO, I also witnessed the beginning of a change in broadcasting. Management started listening to consultants ... who preached quantifying everything and started an end to the pursuit of quality. But in that broadcast career, and later in media relations, I was privileged to work with some history-makers and meet some of the stars among the old pros, including Edgar Bergen; Arthur Godfrey; NBC newsmen Frank McGee, Ray Shearer and the great Chet Huntley, CBS's Walter Cronkite ...

I miss my "golden days with radio." I was

brought up by a father who loved his superregen and even simpler receivers. He taught me an appreciation of the miracle of radio and how to dig out those rare finds all over the LF [low frequency] and HF [high frequency] shortwave spectrum. And he saw to it that I had one of those brand new Hallicrafters S-38s when I turned 16. It came as a hand-delivered surprise from another who worked on the railroad that was my father's career. He'd bought it at World Radio in Council Bluffs, Iowa, from a radio leg-end of another kind, retailer and surplus guru, Leo Meyerson.

The S-38 let me hear Radio Moscow tell us, in 1950, how people were starving in the streets of Omaha in this terrible democracy we were caught up in. I knew better and was disturbed by how they could lie to people like that. The S-38 entertained me with exotic music and language lessons and the venerable BBC ... and Big Ben reassuring me on the hour that "This Is London." I started recording station identification announcements.

I still have the tape, now about a half hour long. It contains many interval sounds and IDs of stations that, alas, no longer exist. The S-38 and its later and older kin, an SX-25, an SX-110 and even a Sky Buddy, gave me daily and nightly doses of Radio Brazzaville, the Windward Islands, Quito, Radio Australia, the CBC's Northern Service with its over-the-fence notes to and from folks snowed in and facing visits from bears and other adversity that seemed hard to imagine.

And in between the shortwave broadcast

bands were the voices from airliners headed to Gander and Shannon, ships at sea and sometimes sinking, towboats putting a crewman ashore on the sand bar nearest his home, 25 miles up the Mississippi from Memphis, Morse Code and Radio Teletype, and women repeating strings of numbers after the playing of "Perfidia." An FBI agent told me that was a spy broadcast. I followed it with crossed long-wire antennas that determined it might be coming from somewhere in Mexico. The FBI agent only smiled when I told him that.

...Two Kenwoods have replaced that old Hallicrafters tube radio and a Drake R-4C that followed it. I inherited that Drake too, from my dad, who spent some time every day up to his last days in front of it, twisting the dial and listening on headphones. The Kenwoods bring me some of the same stations and nations I have listened to all my listening life - with remarkable digital precision and stability. But, the programs are not the same. Too many of the International Broadcasters seem to be aspiring to sound like what they hear from "the States." In doing so, they are giving up their uniqueness and charm and opportunities to explain and gently educate.

There is, after all, nothing wrong with uniqueness. What's the future if we all look and sound alike? And there are the stations screaming about what is wrong with this or that nation or politician or group, and how we all need to send in our dollars to help them continue to scream. What is wrong with that picture? I'll be

first in line to agree they have a right to do what they do, just as I have a right to listen or turn them off.

Give me again that wonderful African and Brazilian-Portuguese music, the crystal-voiced singers from Japan, the stimulating explanations of rural life in the Scandinavian countries and descriptions of winters in Lapland. Pull this world together for me again in long and serialized examples full of the sounds and the voices of the people busy making this complex planet work and who in their singularity, respect, quiet innovation and distinctiveness might hold the true keys to our long-term survival as a species.

No TV, with its intrusive pictures and breathlessness. Radio, quietly, expansively, and as Arthur Godfrey lectured, speaking "to one person only. If there are others in the room, they'll be talking to each other." Radio still does it best. That's why there'll be always some radio receiver close for me, informing, teaching, relaxing and enriching my life until, like my father, the day I die.

We welcome your ideas, opinions, corrections, and additions in this column. Please mail to **Letters to the Editor**, 7540 Highway 64 West, Brasstown, NC 28902, or email editor@monitoringtimes.com. Letters may be edited for length and clarity. Happy monitoring!

-Rachel Baughn, KE4OPD, editor

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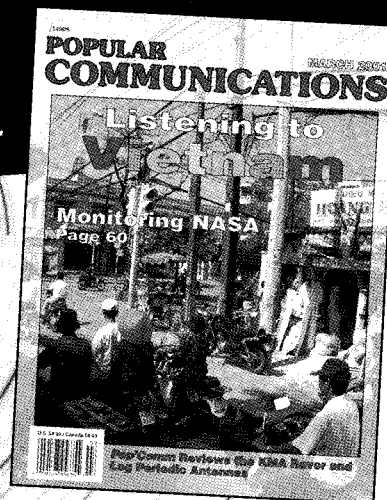
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Radio Honor Roll

Shuttle Search Teams

Communications played a huge part in the search which ensued after the break-up of the space shuttle *Columbia* Feb 1st. Local public safety agencies, national guard troops, federal and state police and emergency services, and hundreds of volunteers were involved in the effort. The volunteers included amateur radio operators, especially members of the Amateur Radio Emergency Service and Radio Amateur Emergency Services.

"Ham radio has proven to be the only reliable communications option during the recovery effort," said Tim Lewallen, a North Texas Public Information Officer for ARRL. "The area's dense forests and hilly terrain make communication via many traditional radio systems difficult."

The shuttle disaster hit close to home for enthusiasts across the country. Through the Space Amateur Radio EXperiment (SAREX) and the Amateur Radio on the International Space Station (ARISS) programs, ham radio operators have enjoyed a special relationship with the astronaut corps, many of whom are Amateur Radio licensees. Three of the *Columbia* astronauts were licensed Amateur Radio operators.

More on Shuttle Search Communications

Given the wide mix of agencies involved, communications companies scrambled to provide federal, state and local agencies with upgraded voice, data and wireless systems. The Federal Emergency Management Agency (FEMA) deployed Mobile Emergency Response Support (MERS) communications vans from the MERS Detachment in Denton, Texas. MERS vans come equipped with a wide range of communications systems, including Ku-band satellite systems, microwave gear to tap into phone-carrier networks and UHF/VHF radios to communicate with state and local agencies. Telecommunications companies brought in COWs (cellular on wheels) to aid in the increased volume of cellular traffic as well as provide coverage in areas without cellular service.

The search has benefited from advances in technology since the loss of the space shuttle *Challenger* 17 years ago. Today, Global Positioning System-derived location data can define the debris field to help narrow search patterns in East Texas, where thousands of pieces of the spacecraft have been located. Staff and students from Stephen F. Austin University in Nacogdoches, Texas, used the data to map the shuttle debris and apply the power of GIS (geographic information system) programs to visualize data and see patterns.

Teams were also on the look-out for what was believed to be a top-secret device that fell

from the shuttle *Columbia*. A report in the *Houston Chronicle* said searchers were looking for a communications device that handled encrypted messages between the shuttle and the ground.

"Bull Ring" dismantled at Rota

In the first weeks of February, the US Naval Station in Rota, Spain, dismantled the 90-foot-tall circular antenna array known as "The Bull Ring." This Cold War relic has been a part of the installation's landscape since 1964.



Part of the military's high-frequency direction finding system, the antenna once helped Navy code breakers track radio signals from aircraft and ships and intercept shortwave voice and message traffic. At one time, the Navy had about a dozen similar circular antennas scattered around the world in places, such as Japan, Iceland and Guam. The Navy will soon demolish its last remaining one in San Diego.

The circular antennas are often nicknamed "elephant cages" or "dinosaur cages," but the Spanish community dubbed the Rota antenna as "The Bull Ring." The antenna had a diameter of nearly three football fields, and it surrounded a small compound where hundreds of Navy cryptologists once worked. Today, the command has between 150 and 200 people and primarily serves Fleet Air Reconnaissance Squadron Two, an EP-3 unit based in Rota.

The Denver Spy Files

Since the 1950s, the Denver police have been secretly accumulating information on local activists – both right and leftwingers – and storing them on file cards in a cabinet. Last year, the department decided to put their intelligence records into a computer program from Orion Scientific Systems which is being used by other agencies as an analysis tool and a means to hunt terrorists. Denver entered 3,400 individuals and groups into the system from the file cards.

The intelligence information came into the open when the data was shared with a neighboring county, and the department's problems started. Several groups, including a Quaker service organization and recipient of the Nobel Peace Prize, were categorized as "criminal extremists." Some of the organizations have brought a lawsuit against the city.

"I don't think they had a clue what the capacity of this was and what they were doing with it, honestly," said Jean Dubofsky, a former Colorado Supreme Court justice and member of a panel appointed by the mayor, which concluded that not one of the 3,400 police records could be legitimately retained.

The files are now being released to the individuals as they are being purged. They are also being made public by both Denver newspapers. One of the first cases to be published is of a 45-year-old Littleton man who picked up his CB radio microphone while driving through Nebraska and started talking about the Constitution. The conversation landed him in the Denver Police Department's "spy files." The man was stopped by a state trooper who apparently heard the conversation on his scanner. The incident occurred three months after the Oklahoma City bombing, when militia groups with extreme constitutional views were under heavy scrutiny.

Amateur Radio Spectrum Protection Act

The Amateur Radio Spectrum Protection Act has again been reintroduced by Florida Rep Michael Bilirakis in the US House of Representatives. The ARRL legislative initiative HR 713 has been referred to the House Committee on Energy and Commerce.

HR 713 is aimed at ensuring the availability of spectrum to Amateur Radio operators. It would protect existing Amateur Radio spectrum against reallocations to or sharing with other services unless the FCC provides "equivalent replacement spectrum" elsewhere. A Senate version of the bill is pending.

The ARRL is urging members of the Amateur Radio community to contact their representatives in Congress and request that they cosponsor HR 713. A sample letter is available on the ARRL Web site.

—ARRL

War Threat a Boost for SWLing

Kim Andrew Elliott of the VOA forwarded a comment from the *Boston Daily Globe* in which a poll of travel executives regarding wartime contingency planning concludes, "Of those polled, 99 percent said their companies have a plan in place to either evacuate or locate stranded travelers in the event of a war or terrorist act ... Asked what other items ought to be part of disaster readiness, most said first-aid kits, compact shortwave radios, contact numbers, and local Internet access."

An internal memo from Clear Channel KFBK, regarding preparations to cover "the upcoming war," includes this advice, "if possible, can we have a short wave radio wired up in the newsroom so that we can capture audio."



April 13: Madison, WI

Madison Swapfest at the Mandt Community Center (Stoughton Junior Fair Grounds on South Fourth Street), 8a.m., admission \$5, talk-in 147.15. Free parking. For more info see <http://www.qsl.net/mara/> Call 608-245-8890 or write Madison Area Repeater Assoc., PO Box 8890, Madison, WI 53708-8890.

Obtain a copy of the latest edition of *Monitoring Times* magazine, which lists all of the International English language broadcast stations. If we don't have one in the family I would recommend pricing the Sony ICF-2010 (or its equivalent) for a good, moderately priced, portable short wave radio with an antenna on the roof."

Waging an Electronic War

Military experts believe the next war will be primarily fought with electromagnetic energy rather than munitions. Bursts of photons will destroy an enemy's electronic systems.

Modern electronic warfare uses aircraft (like the Navy's carrier-based EA-6B Prowler) to monitor the electromagnetic spectrum and deny an adversary's use of radar and wireless communications by overwhelming it with electronic "noise." Specific transmitters can be identified and suppressed or manipulated. Enemy radars can be remotely programmed to give false information. Electricity can be cut off by dropping carbon filaments on power lines to short them out.

"Directed energy" is the most secret form of electronic warfare. These high power microwave and lower-frequency weapons can penetrate enemy electronics to erase memories, upset software, and even burn out components. Control of the electromagnetic spectrum has become as important as command of the air.

— Fred Maia W5YI

OBITUARIES

H TAYLOR HOWARD

(Henry) Taylor Howard, well-known pioneer of TVRO satellite dishes, and his stepson, Brian, were killed while Howard was attempting to take off in a private aircraft November 13, 2002. His legacy includes the first private C-band big-dish satellite receiver in 1976, spawning a generation of enthusiasts who, using Howard's popular "The Howard Terminal Manual," built their own systems. Howard founded the Society for Private and Commercial Earth Stations in 1980, which merged in 1987 with the Direct Broadcast Satellite Association to form the Satellite Broadcasting and Communications Association (SBCA), of which Howard became Chairman of the Board.

Howard was also founder of the early satellite TVRO manufacturer, Chaparral Communications. Lesser known are his contributions to the Stanford University "Big Dish" project which radar-mapped the surfaces of planets in our solar system in the 1950s and '60s.

Howard was the recipient of the coveted NASA Medal for Exceptional Scientific Achievement for his contributions to the agency's Apollo program. The T. Howard Taylor Foundation was founded in his honor in 1994 to encourage people of color to pursue careers in satellite communications.

GEORGE HENF, KK4CW

George Henf, co-founder of GAP Antenna Products, died unexpectedly at his home in Sebastian, Florida, November 8, 2002. With his son, Richard, KD4DQN, Henf is best known for his innovative, vertical, HF antenna systems comprising self-supporting masts and requiring no ground plane.

Contributions may be made in his honor to the KK4CW, George Henf, Scholarship Fund, 99 Willow St., Fellsmere, FL 32948. The fund sponsors young amateur radio operators who wish to pursue a college education.

"Communications" is compiled by editor Rachel Baughn KE4OPD from newscippings submitted by our readers. Thanks to this month's contributors: Anonymous, Albany, NY; Sterling Marcher, La Mirada, CA; Ira Paul, Royal Oak, MI; Doug Robertson, Oxnard, CA; Brian Rogers, Melvindale, MI; Richard Sklar, Seattle, WA; Matt Stanley, NY, NY. Via email: John Diefenbach, Jock Elliott, Kim Andrew Elliott, Wayne Glen, Bob Grove, Sheldon Harvey, Ed Muro, Jerry None, John Mayson, Bill Siedsma, Larry Van Horn, Peter Vieth, Barry Williams, Greg Williams, Robert Wyman, ARRL, and the W5YI Report.

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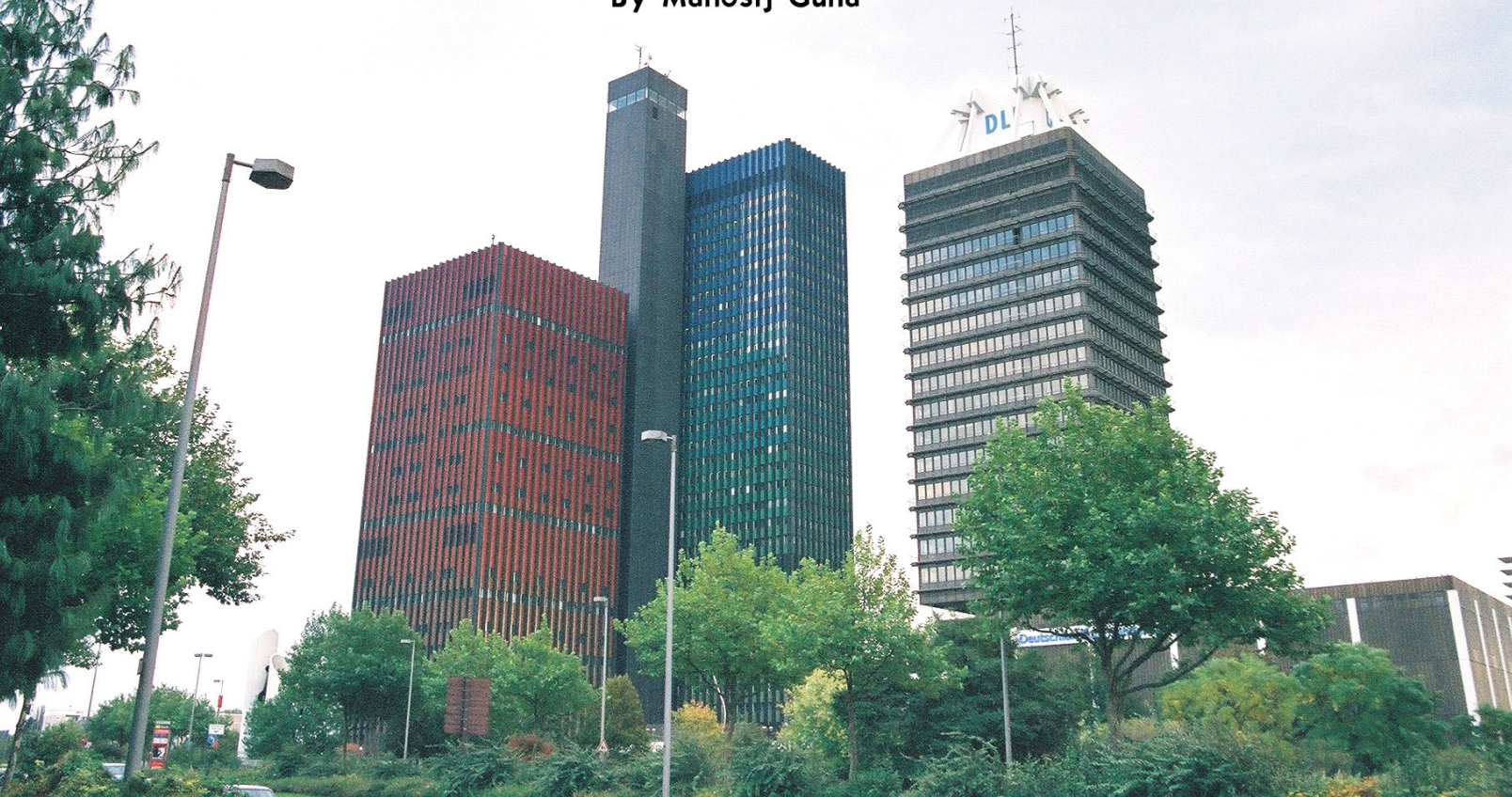
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Radio in Germany

FROM SPARK-GAP TO DIGITAL SHORTWAVE

By Manosij Guha



credit: Manosij Guha

Radio broadcasting in Germany has come a long way since its early beginnings, largely due to German engineering ingenuity and perseverance, and despite the massive disruptions of two world wars. On May 3rd, modern Germany's renowned foreign service, Deutsche Welle, will celebrate 50 years of broadcasting. As if to mark the occasion, in June, DW will be the first to launch regular broadcasts in the revolutionary mode of digital shortwave. But first, let's reminisce on how Germany got from Hertz to here.

Early beginnings

The ether above Karlsruhe Polytechnic in Germany was never quite the same, ever since 1887 when Heinrich Rudolf Hertz rewrote the theories propounded a decade earlier by British physicist James Clerk Maxwell, which of course were then debunked by the confirmed skeptics of his day.

In his laboratory, Hertz passed electricity through a pair of one-meter-long wires with a spark gap connected to an induction coil. Several trials and tribulations later, the product was electromagnetic waves. This was a unique discovery, and he unknowingly heralded a brand new way to communicate, namely *radio*.

But this prime invention gathered dust for a decade, until in 1897 when two eminent German scientists from Allgemeine Elektrizitäts-

Gesellschaft or AEG (General Electric Company), Prof Adolph Slaby and Count Georg von Arco, put the Hertzian techniques to a practical test. There was stiff competition from Marconi in England and from Siemens and Halske, another German company.

Since national pride was at stake, the two German companies decided to work together, putting commercial rivalry aside. On 30th August 1897 an antenna was installed on the spire of the Heiland church in the tiny village of Sacrow, not very far from the German capital Berlin. Using the "spark gap" transmitter similar to the one constructed by Hertz, the first wireless transmission was made between a technical college and a chemical factory, covering a princely distance of 500 meters (around 1640 feet), beating their English competition, but not by a mile.

Telefunken and Nauen

With the validation of this brand new communication technology, large-scale development soon followed. On 27th May 1903, compatriots Emil Rathenau and Werner von Siemens founded the Gesellschaft für Drahtlos Telegraphie (Wireless Telegraph Company) with the now famous trademark Telefunken. This was further cemented in 1906 with the establishment of the wireless telegraph station in Nauen, around 25 miles northwest of Berlin.

A huge tract of swampland provided perfect electrical conductivity and were ideal conditions for wave propagation.

By 1909 the station was on air with a spark gap transmitter pumping in 10kW of power to its antenna and its signals were picked up as far afield as Tenerife, nearly 2236 miles away. For the next three years, with the power augmented to 35kW, the wireless station in Nauen became Germany's official "tomtom" and was essential in keeping in touch with its far flung colonies in Africa, several thousand miles away. In 1911, the station achieved super power status with a transmitter of a whopping 100 kW and new 260 meter antenna.

With the outbreak of the First World War in 1914, contacting German ships through this station became a priority, to guide them to neutral harbors, especially as Britain began systematically severing Germany's undersea telegraph cables to the rest of the world.

With archenemies Britain and Germany eavesdropping on each other's radio traffic, all messages are sent in code. Not to be outdone, the British Army soon developed a wireless direction finder to track German ships. The Nauen station continued to be the sole means of communicating with the German colonies and gained importance with its power further increased to 150kW. During the course of the war, the wireless station in New Brunswick, on the east coast of North America, exchanged mes-

sages with the station in Nauen, one of them being American President Woodrow Wilson addressing the German people exhorting them to overthrow the Kaiser and end the war. This was the first time the US administration tried to stir up an uprising by radio, and it was certainly not the last...

Thousands of miles on a flea power

In the mid 1920s, the station at Nauen was able to communicate with its counterpart in faraway Argentina on the shortwave frequency of 4 MHz with a transmitter power of 800 watts – a far cry from today's megawatt transmitters in a cluttered ether. Consequently, the station graduated from longwaves to shortwaves, as the latter was decidedly the better wavelength for long range communications with minimal power.



The main transmitter building at Nauen, now restored. Courtesy Wumpus

Flushed with the success of this global hop, wireless links were extended in 1926 to the US, followed by Central and South America and the Far East. The corresponding station in the US was located at Sayville in Long Island which was also built by Telefunken.

The Deutsche Reichpost (then German Post Office) took over the reigns of the station on 1st January 1932, complete with its super power transmitter and 250 hectares of land. By 1939, Nauen became one of the largest shortwave transmitting stations in the world. But it also secretly maintained its longwave facility for communicating with the German U-Boat fleet, for longwaves had far greater penetration underwater than its shorter cousin.

During the Second World War, the station was miraculously unscathed despite the carpet bombing of neighboring areas by allied bombers. But on 24th April 1945, the station was nevertheless decimated by the occupying Russian Red Army who dismantled the transmitters and blew up the antenna mast with dynamite. The majestic main building somehow survived. The Nauen station sank into disrepair and oblivion, though the historic station eventually saw a grand revival during the Cold War – but we will pick up that story later in the timeline.

Hitler, Third Reich and Zeesen

Meanwhile, in the early 1930s, Germany went through tumultuous times politically with the establishment of the Third Reich (Rule). The National Socialist Party (Nazi for short) came to power with Adolph Hitler at its helm. It didn't take the political leadership long to figure out that the tremendous reach of short-

wave radio could be put to a different use. Major telecom giants such as Telefunken and Siemens were commissioned to build large shortwave transmitting stations and broadcasting complexes. Twenty miles southeast of Berlin, a new transmitter base was established at Zeesen by AEG Telefunken, with a primary function – to broadcast endless propaganda. Using call signs ranging from DJA to DJR, soon the 12 shortwave transmitters were beaming the Nazi voice to the rest of the world on the 49, 31, 25 and 19 meter bands through its numerous high gain antennas.

At that time, the genre of programming was rather refined and subtle. A daily diet of entertainment was served up with concerts and competitions with free promotional material sent readily to anyone who listened in. By 1933, Germany began broadcasting English language programs to the world to gain support for its ulterior motives, while non-German radio programs at home were *verboten*. The external programming became increasingly strident, and finally in 1938, Hitler broadcast his true intentions loud and clear to other nations.

Incidentally, the programs at that time didn't criticize the British imperial and colonial rule much, but reserved its ire for the Bolsheviks in the Soviet Union. But as German propaganda went anti-Semitic to the extreme, it started ominous rumblings across the narrow channel in Britain, eventually leading to the hostile situation which would turn the world as we know it upside down.

In this unsavory discussion of using radio as a weapon of war, it needs to be pointed out that, even though Germany did not consider Britain as enemy number one, it devoted a considerable chunk of its broadcasting apparatus toward its island neighbor. Yet another transmitter station was constructed in Osterloog in 1938. The 100kW sender and intricate antenna system put in a sizable signal over the all-sea water path to England.

This balance shifted with the onset of the Second World War, and the Reichse Rundfunk spent the next year in developing programs that would appeal to and be credible to the class conscious society in England, and it culminated in the recruitment of William Joyce, a learned upper crust English gentleman of Irish descent, who was extremely articulate, besides being fluent in German. He went to work reading the news from the Hamburg studios in his distinctive upper class accent, largely lauding the *blitzkrieg* of the German panzer divisions through the lowlands of western Europe. His broadcasts, though initially well received, did not go down with the British gentry and was mocked as "Lord Haw Haw" by the local newspapers. The British leadership was so filled with disdain, that after the war was over, he was captured, charged with high treason and hanged after a summary trial.

As the war progressed, the German war machine, the Wehrmacht, swung into action and several vital installations including high power broadcasting stations and associated studios fell under its sway. By the summer of 1940, Germany had in its control almost every broadcasting station in continental Europe, which ex-

tended from the Arctic Circle, from Tromsø in Norway, to Holland, France, Luxembourg, and the Mediterranean. Earlier, stations in eastern Europe – Radio Prague, Radio Warsaw and Radio Belgrade – were already reeling under the Nazi yoke: This made Germany singularly the largest broadcasting network in the world.

With the march of the German Afrika Korps to the shores of North Africa, a few small mobile broadcasting units were built by Telefunken to serve the ever changing frontlines. These units comprised of several trucks each carrying a stage of the radio station, and were usually 20kW MW or 50kW LW in power. Each of them was given a glitzy transmitter personality such as "Lebenslauf des Sender Fritz" and "Lebenslauf des Sender Heinrich." Soon the voices of famous German entertainers, such as Lilli Marlene and Marlene Dietrich, were wafting across the desert sands. The broadcasts became a key ingredient of the morale booster for the German soldiers, besides being quite a hit with the soldiers of the British Expeditionary Forces.

With the changing fortunes of the German forces towards the end of the Second World War, most stations were destroyed by the victorious Allied forces, but a few were liberated intact and turned around for Allied propaganda and psychological warfare against the retreating German soldiers. The German armed forces finally surrendered unconditionally on 8th May 1945, and the Reichse Rundfunk ceased to exist. And it was a while before the German voice was heard on radio again ...

War and peace

Regular shortwave broadcasting from Germany did not start again until the 1950s. With the Allied forces dividing the country to West (Federal Republic) and East (Democratic Republic), each country established its own broadcasting setup.

The federated structure of the Federal Republic meant that each of the 13 states had its own radio station, operating as many as 50 stations. Most of them had powerful transmitters operating mostly on VHF-FM as use of AM on mediumwave and shortwave was restricted. But some, like Deutschlandfunk, an information service for foreigners in eastern Europe, used shortwave, as its audiences lay deep behind the iron curtain. The plethora of these broadcasting entities were grouped under an umbrella organization, going by the mouthful "Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland," which has a rather short acronym, ARD.

In addition to the public service broadcasters, there were many commercial and military outlets, controlled by the occupying powers of France, the United Kingdom and USA. The war torn nation was also host to a handful of propaganda stations: Voice of America, Radio Free Europe and Radio Liberty. Elaborate studios were built in Munich with high speed links to the major studios in the US, in Washington DC, and in New York. Live or taped programs in a myriad of east European languages were fed to the transmitting stations located at

Bilbis, Holzkirchen, and Lampertheim in Germany, besides other relay bases in Portugal and Spain, broadcasting a predominantly western voice to the countries in the eastern bloc and making it a prime weapon in the Cold War that ensued.

Reflecting the geo-polity at that time, Berlin was a special case being divided into East and West. Rundfunk im Amerikanischen Sektor (Radio in American Sector), better known as RIAS, was set up to showcase West Berlin, and, according to some, funded clandestinely by the CIA. The station, incidentally, broadcast also on shortwave using an AEG Telefunken-built 100kW sender, which carried its signal far beyond the wall that separated the two parts of the beleaguered city.

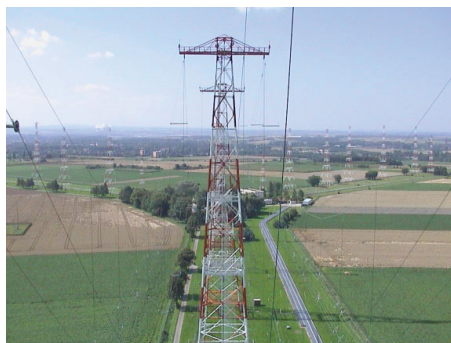
To stem the western propaganda coming from right in the middle of East German territory, East Berlin (the capital of the German Democratic Republic) established its own foreign broadcaster in 1955, Radio Berlin International, which used super-powered medium and shortwave transmitters to take its voice to Europe and the rest of the world. Two years later, the historic transmitting station in Nauen was retrofitted with Soviet-built 500 kW transmitters, and another antediluvian site in Koenigswusterhausen was resurrected. This started a radio race between both sides, and soon RBI was broadcasting 75 hours of programming in 11 languages, vainly trying to correct the information overload.

On the other side of the border, the most significant development in German broadcasting came in the founding of its foreign broadcasting arm, Deutsche Welle (German Wave) – exactly 50 years ago. After a lot of wrangling, it went on the air on May 3rd, 1953, with a German-only service. The Allied High Commission, which was overseeing the affairs of Germany, refused to allow anything else. This was promptly rescinded, however, and foreign language programming was authorized in a few days.

The inaugural broadcast was started by a landmark speech by then German president Theodor Heuss addressed to “*an die lieben Landsleute in aller Welt...*” (“our cherished countrymen around the world...”), beginning a new era in European broadcasting. His speech kicked off a three-hour program, which was then transmitted in five directions at different times for a total of 15 hours.

Elated with the permission to broadcast in foreign languages, within a year the new station was able to produce 5-minute segments in English, French, Spanish and Portuguese. A transcription service was also launched to supply English-language programs to university radio stations in the United States.

Like the emperor’s new clothes, a new station with a new mission meant that it had to have its own dedicated transmission facility. Allied bombing during the Second World War had blown up most of the shortwave transmitting facilities, and the sole surviving one in Munich-Ismaning was commandeered by the occupying troops. Therefore, in 1956, the Deutsche Bundespost (Federal German Post) installed its first shortwave transmitter in Jülich,



Deutsche Telekom transmitting station In Jülich above is quite in contrast to those at the DW measuring station at Bockhacken, designed as an underground bunker which is a beehive of reception gizmos.

Photo Credit: Juelich: Roman Goslawski. Bockhacken: Manosij Guha



not far from Cologne, again using the technical know-how of AEG Telefunken.

Today, the station has grown to include twelve 100 kW shortwave transmitters, managed by Deutsche Telekom, the successor to the German post office. Besides continuing to relay some programs of the Deutsche Welle, it now carries programs from a host of commercial clients and has fast become a major player in the sale of transmitter time.

A few years after the Jülich station went on air, a measurement and reception station at Bockhacken, in the highlands near Cologne, also began operations.

Expansion and relay stations

Expanding its listener base to Africa, a relay station was established in 1965 in Kigali, Rwanda, complete with a complement of three 250 kW shortwave transmitters built by Marconi. In April 1994, as civil war raged in this tiny central African nation, rebels surrounded the complex, trapping the employees



Antenna work at Wertachtal transmitting station, Courtesy: DW Foto Archiv

inside the building. The German staff members were rescued by a special unit of the Belgian armed forces, but many of the local Rwandan employees were probably killed.

The decade of the '70s saw a dramatic growth in transmitter capacity and signal reach. As the facility at Jülich reached its capacity for expansion, the Federal Government in Germany authorized the Deutsches Bundespost to build a new, modern shortwave transmitter site. The result was a 200 hectare super-power facility at Wertachtal, near Munich in the south German province of Bavaria. It went on air in 1972, initially with four 500 kW transmitters primarily broadcasting the Olympic Games in Munich to the world.

By 1989, the station had expanded to include fifteen 500 kW transmitters, placing it among the most modern and largest shortwave centers in the world. Since 31st December 1995, four of these transmitters have been leased to Voice of America, Radio Free Europe and Radio Liberty. The Wertachtal station also serves as a relay station for international broadcasters such as Radio Canada International and Radio Nederland Wereldomroep, with whom a radio swap agreement has been worked out. Its spare capacity is also used to catch to the overflow of commercial clientele from the Jülich facility, from which transmission can be moved at short notice to Wertachtal.

This decade also saw the establishment of a relay station at the port city of Sines in Portugal in 1970. The station is still operational and houses three 250 kW shortwave transmitters manufactured by Marconi being fed into six slewable, high gain, log periodic curtain antennas.

In 1973, negotiations with the BBC were completed for the joint construction of a relay station on the Caribbean island of Antigua; it finally went on air in 1976 with four 250 kW Marconi-built shortwave transmitters. The relay station in the Caribbean island of Monserrat, which is plagued by cyclones, was closed down in 1989.

On 4th November 1974, a relay station at Cyclops in the picturesque Mediterranean island of Malta began operations. There were three 250 kW shortwave transmitters and a 600 kW mediumwave transmitter built by Telefunken, which put in a strong signal to the Middle East and South Asia. This facility was closed down in 1996 as more effective relay site was found in Sri Lanka and as airtime from Asian broadcasters became readily available.

In the early '80s, reception of Deutsche Welle in South Asia improved dramatically with setting up of a relay base in the region. The relay station in Trincomalee in north eastern Sri Lanka was the cause of a lot of grief to begin with. Even though it was operational in 1984, the insurgency by the Tamil guerillas put it right in the middle of a war zone. Only when the Indian troops established an uneasy peace towards the end of 1988, was the station able to operate with full power with its three 250 kW Thomcast shortwave transmitters and its lone 600 kW mediumwave transmitter. Even then, the station was intermittently on the air during the following years as political unrest dogged the region.



Thomcast rotatable antennas at Nauen, courtesy DW Foto Archive

In 1980, Deutsche Welle moved into its swank, new broadcast center on the Raderberggürtel in Cologne. The twin towers, along with those of Deutschlandfunk, adorn the skyline of the city.

Reunification and reorganization

With the German unification on 3rd October 1990, there was massive reorganization at Deutsche Welle, in which some of the staff members, frequencies and transmission equipment of Radio Berlin International (the now defunct foreign broadcasting service of the former East Germany) was absorbed. In a similar process the two telecom entities merged, and Deutsche Telekom took over the transmitting stations at Nauen and Königs wusterhausen. While the former site has been refurbished, the latter has been turned into a quaint broadcasting museum.

The transmitting station in Nauen in the east German province of Brandenburg, was a major inheritance from the former East Berlin broadcaster, with three 500 kW and one 100 kW transmitter of Russian origin. These transmitters are used as standby transmitters, but the old antennas were torn down in 1999. In 1997 new state of the art 500 kW transmitters from Telefunken replaced the old ones, and four rotatable antennas built by Thomcast to their own design were added. Deutsche Welle now has a total of nineteen 500 kW transmitters, including the four leased to Voice of America from Wertachtal.

With the collapse of the Soviet Union, the Cold War was over, and the transmitters used for jamming western broadcasts lay fallow. In August 1990, Deutsche Welle signed a cooperation agreement with Radio Moscow, and took over the former Soviet radio jamming sites near the cities of Kuibyshev, Novosibirsk and Irkutsk. The old transmitters are refitted to serve as effective relays for its broadcasts to Asia.

A continuing evolution

From its modest beginnings, in a decidedly tri-media approach (radio, television and the internet), the German voice is becoming a broadcasting super-power with a loyal listenership around the world, and it has diligently kept pace with the changing face of world events, technology, and audience trends. Deutsche Welle not only focuses on a worldwide audience of people with an interest in Germany and Europe, but the programs are also designed for people learning German, and also for Germans living abroad as a "bridge to home."

Deutsche Welle broadcasts round the clock in German, and provides well as more than 70 hours daily in 29 other languages. Unlike other public broadcasters in Germany, which are funded by radio license fees, Deutsche Welle is financed by an annual allocation by the federal government, generated from tax revenues. The budget for 2002 is about 285 million Euro, which converts to a like amount in US dollars.

Some 1,500 employees from 70 countries work at headquarters in Cologne and in the German capital Berlin in the language services, technical support, and administration. In addition, it maintains external studios in Washington, Moscow, and Brussels, and co-operates closely with the network of correspondents operated by the German public broadcasters ARD and ZDF.



Brain Pickering of the English Service reading the news at the Cologne studios, courtesy M Guha

English programs have been of major importance to Deutsche Welle, because it is not only the lingua franca in many parts of the world, but is also used by millions as a second language. The English Service being one of the larger language services, it employs 30 journalists including three managing editors who collectively produce news, current affairs and fea-



The author with Andrea Schulz, of DW's High Frequency Department, analyst for reception reports from Asia.

ture programming for broadcast to various parts of the world.

"We hope to tailor our current affairs output to the requirements of our audiences in different parts of the world to an even greater extent than we do already," says Irene Quaile-Kersken, Features Editor in the English Service. "We are fortunate in being located 'at the heart of Europe,' and we make the best of that. Even in times of financial constraint, we have been able to maintain a high level of information broadcasting, which has brought us a series of international awards for our features and documentaries in recent years, including gold medals in the New York International Radio Festivals and from the United Nations. We're proud of those achievements and certainly plan to keep that up during our jubilee year."

North America with its large English speaking population has been one of the primary target areas for Deutsche Welle's English Service. Besides programs made in Cologne tailored to suit the American taste, catching the local flavor is a well-equipped studio in Washington, DC, headed by Rüdiger Lentz, who has been featured by *Time* magazine for his illustrious reporting.



The master control room at the Cologne broadcast center, courtesy M Guha

The English Service will experience the biggest facelift in its 40 year history with the start of summer time on 30 March 2003, with a substantial increase in the number of daily news bulletins from 13 to 24.

"News every hour will be our visiting card," says Uta Thofern, Head of the English Service. *Newslink*, the flagship current affairs program, will be broadcast round the clock in the form of special editions tailored to meet the requirements of different audiences around the world.

Changes will also be made to the feature programming with an increased emphasis on rebroadcasting successful programs, and more attention will be paid to the environment.

In North America, special emphasis will be placed on expanding the rebroadcasters like the Canadian Broadcasting Corporation or ABC News Radio, which has already been rebroadcasting the German voice for a while. This will perhaps make up for the loss of the English Service on shortwave, which has since been discontinued.

Deutsche Welle reaches most people through its foreign-language programs. "If Deutsche Welle was a company, I would say the foreign-language program were our main area of business," exhorts Miodrag Soric, Editor-in-Chief of Foreign Language Programs. "Direc-

tor-General Erik Bettermann has decided that DW should concentrate on the regions of eastern and southeastern Europe and what is known as the 'Islamic world'. Why these particular regions? Of course this is related to Germany's foreign-policy interests and the events in the USA on September 11th, 2001."

Some 28 million listeners tune in to Deutsche Welle on a regular basis. Nearly 700,000 listeners wrote letters and emails in the last year, creating a new record. Much of it was reception reports filed by monitors far and wide. "Listener's reports are very important, as it shows interference very early on in the new schedule period," says Waldemar Krämar, head of the Technical Monitoring Department. "People in the target areas should write to us so that we can optimize. We have a lot of listeners spread throughout the target area, so we have a good idea of the quality of the signal." He further adds, "So it is very important, that monitors write to us and it is important that they do that quickly."

Deutsche Welle now radiates its programs over 39 shortwave and two mediumwave transmitters. Besides operating its own relay stations in Portugal, Rwanda, Antigua, and Sri Lanka, it also rents airtime on shortwave transmitters in Russia, Madagascar, Bonaire and Canada from cooperating broadcasters and telecoms. It also uses medium wave transmitters in Belgium, Moldova, Macedonia, Russia, Albania and Sri Lanka, while FM transmitters are used in Bulgaria, Rwanda and Kosovo. This impressive lineup of transmitters is further complemented by almost 4500 rebroadcasters scattered around the world, who are carrying Deutsche Welle programming in full or in part.

A moving experience with a golden glow

Throughout the past year, the broadcasting center and headquarters in Cologne has been moving in stages to the Schürmann Building in the old German capital, Bonn, about 25 miles away. Designed by and named after the Cologne architect Prof. Joachim Schürmann, the building was originally meant to house the offices of deputies to the German parliament. But when it was decided to restore Berlin as the seat of government for unified Germany, this building remained without a purpose.

Meanwhile, Deutsche Welle was plagued by a high concentration of asbestos and the associated health risks in the broadcasting center in Cologne, and had been looking for new

quarters. At Christmas 1993, rising flood waters from the Rhine caused major damage to the Schürmann Building, which was still under construction. Since then, the nine-building complex has been renovated and has given a completely new fit, just in time for DW's golden jubilee celebrations.

To commemorate the 50th anniversary, Deutsche Welle has issued two new QSL Cards, one for the jubilee and other for commencement of DRM broadcasts from its relay station in Sines, Portugal. Also, in May 2003, the German post office, Deutsche Post, will release a new postal stamp featuring the broadcaster's 50th birthday.

Digital Radio Mondiale

Digital Radio Mondiale, or DRM for short, was founded in 1998 in Guangzhou, China, to develop a digital system for long, medium and shortwave radio. It is a global consortium with 74 members from 29 nations, which includes international broadcasters, businesses, research institutes and other organizations from the media sector. With Peter Senger, chief engineer at DW, as chairman, the goal is to digitalize the shortwaves into a VHF (FM) quality.

Existing transmitters in Jülich and Sines have been modified to carry this new signal, cutting energy costs by more than 50 per cent. Initial success of the digital shortwave broadcast tests from Jülich earlier in December 2002, has prompted Deutsche Welle to become the first broadcaster to start regular DRM transmissions. In June 2003, the DRM service will broadcast 8.5 program hours daily in German, English and Arabic to all Europe as well as the Middle East.

"DRM is the one achievement in the last



Irene Quaile-Kerksen, Features Editor, English Service

century, that will really be a revolution in the AM band," opines Norbert Schall, an engineer leading the DRM research at Deutsche Welle's Technical Advisory Service. "We have a lot of indications that broadcasters are interested in installing DRM for better quality audio, possibility of a supplementary data transmission, and of course energy savings." But conversion to DRM is a costly exercise. "You cannot real-

American Connection

Arco, Idaho, a small town on the Snake River Plain, was named after the Count von Arco, one of the pioneers of German radio. How that came to be is quite interesting.

In 1901, the town, then known as Root Hog, moved the location of their town to take advantage of the intersection of two stagecoach routes and a spur railroad building west from Blackfoot, Idaho. Initially the town leaders applied to the U.S. Post Office for the name, "Junction."

The Postmaster General thought the name too common and suggested that the place be named Arco for Count Georg Arco who was just then visiting Washington, D.C. So, if ever you're out on the barren plain in central-east Idaho, about 75 miles northwest of Pocatello, you'll have made a connection to the history of German radio!

Credit: www.wumpus.de

German-Run Station Opens in Kabul

A Germany-funded radio station, "Voice of Freedom," started broadcasts to Kabul in Dari and Pashto on 4 August 2002. Programming on the FM station includes news, music, features and language courses. The station is based in the German military camp to the east of Kabul. German experts have trained two Afghan newsreaders and several technicians to work for the station. Richard Hunsicker, spokesman for the German forces, says that the running costs of US\$ 2,000 a month come from the German military budget. The station was officially opened by Afghan Minister of Information and Culture, Sayed M. Raheen.

Credit: Media Network, Radio Nederland Wereldomroep



The control room at Jülich, courtesy M Guha



DRM equipment at Jülich

istically modify a 50 year old transmitter, as the cost will be high. On the other hand, DRM with a modern transmitter, and an 80 kW transmitter will put out the same efficiency of a 250 kW one. As the energy is distributed over the entire spectrum, not just the carrier, the peak envelope power is still the same, and that is what goes into the power bill."

Conversion of a transmitter at the relay station in Trincomalee, Sri Lanka, later in 2003 will allow adding more programs to the DRM menu, this time directed towards Asia. By 2005, there are plans to start DRM broadcasts for America with the conversion of newer transmitters in relay stations at Antigua and Kigali, Rwanda.

Presently, the Deutsche Welle is making test transmissions daily, modulating its English Service in the DRM standard towards northern Europe from a 250 kW transmitter in Sines, Portugal. It is radiating less than half the power running at a mere 80 kW and can be heard from 0930 to 1200 UTC on 15440 kHz. A new QSL card is available to confirm the reception of these broadcasts.

www.dw-world.de

Surfing a world of difference

Since the fall of 2001, <http://www.dw-world.de> has been Deutsche Welle's new internet presence, and it was among the first international broadcasts to stake this milestone. For users of the world-wide web, the site not only offers news, current affairs information, analyses, background features and documenta-



Peter Senger, chief engineer at DW, is chairman of the DRM consortium.

ries in 31 languages, but also stock exchange bulletins, program previews and reception information on how to tune in. It has content to suit every palette, be it audio and video, live or on-demand, or text-integrated audio and video components.

"This is no small task, given the various

audiences that we are trying to reach while simultaneously gathering and processing feedback," says Guido Baumhauer, head of DW-Online. "To achieve this, we have implemented a trimedia strategy where our Internet property, DW-WORLD, plays not only an integral role in bringing together our radio and television offerings but also acts as a standalone medium in its own right. Moreover, the Internet creates a perfect platform to gather and process user feedback quickly and accurately for all our mediums."

From a pioneer sender, to a digital monolith: the story of German radio makes a good read and might simply be a prelude – a prelude to another chapter that has only just begun, for far greater challenges for broadcasting lie ahead!

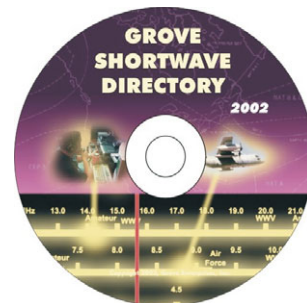
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About the Author

Manosij Guha is a TV news and documentary producer, who worked in New Delhi, for many years. He is also an avid shortwave listener and monitor, and has traveled in Asia and Europe to report on their unique style of broadcasting. He presently resides in Seattle, WA.

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Digital Radio Mondiale - HiFi for AM Radio

By D. Prabakaran

There is a global shift from analog technology to digital in radio and communications. Digital technology is transforming the television and radio broadcasting scenario, providing superior technical quality within the existing limited spectrum bandwidth. Beginning the first of June, the first regular digital shortwave broadcasts will be initiated by Deutsche Welle. Putting aside both the hysteria and the hype, what exactly is the new mode, why is it needed, and how can the listener tune it in?

A Little Background

Radio broadcasts first evolved using amplitude modulation (AM), now used on the shortwave, mediumwave, and longwave transmission bands below 30 MHz, often referred to as the AM bands. AM radio provides wide area coverage at low cost. Thanks to the propagation characteristics of lower frequency waves, AM band signals are able to propagate further as compared to frequency modulation (FM) band signals on VHF frequencies (88-108 MHz).

Signals on the AM band may propagate directly from transmitter to receiver along the surface of the earth as ground waves (in longwave and mediumwave bands), or indirectly via the ionosphere that refracts the signal back to the earth as skywaves (in shortwave and mediumwave bands).

High-frequency (HF) bands facilitate international broadcasting through skywave propagation. Broadcasts can be targeted at distant countries, even halfway around the world. However, most major broadcasters arrange to have transmitters somewhat nearer the target area in order to improve reliability and give more choice of operating times and frequencies.

But AM radio has a major drawback: it offers poor sound quality due to interference from man-made noise and fading. Audio quality on shortwave and mediumwave varies considerably due to the dynamic variations in the propagation medium. This, coupled with limited audio bandwidth, has led to a reduction in the radio audience as broadcasters explore alternative spectrum and media to entice the listeners.

Two new digital technologies are just now opening the way for better reception quality – digital audio broadcasting (DAB) is the digital

evolution for FM radio, and Digital Radio Mondiale (DRM) is the digital standard for the AM bands. In contrast to AM transmission, DRM offers the broadcaster the ability to adopt a considerable number of transmission parameters to suit the transmission channel. It provides broadcasters the flexibility to strike an optimum balance between quality and reliability of the service. DRM's FM-like quality offers a dramatic improvement over the crackle and pop of analog AM.

Why is a digital transmission system needed below 30 MHz? Digital technology offers many substantial advantages to national and international broadcasters and infocasters. Even FM broadcasting is gradually moving to a DAB standard. But as the coverage of FM is very limited, the advantages of a complementary digital broadcast system below 30 MHz are becoming clear for national and international broadcasting.

The poor transmission quality that is associated with the analog AM system is mainly due to the frequency band. Even so, when the amplitude modulation is replaced by digital modulation, it will be possible to obtain a good-quality transmission even at long distances. Because digital transmission is non-sensitive to echo interferences, it avoids quality degradations that are typical of analog transmission.

DRM consortium

To create the digital AM broadcasting system, an informal meeting was held between some of the largest international broadcasters and broadcast equipment manufacturers in Paris in September 1996. The meeting included representatives from Radio France International, Deutsche Welle, Voice of America, Harris Broadcasting Communications, Northing, and Thomcast Co. In another meeting held in November of the same year, it was agreed to form the Digital Radio Mondiale (DRM) consortium to create a single world standard for digital broadcasting in AM radio bands below 30 MHz. The DRM consortium comprises broadcasters, communication system developers, and electronics manufacturers.

The DRM set out to develop a new digital transmission specification, drawing on work previously done within a European Eureka Project. A preliminary system was designed and

tested within the laboratory using transmitter and channel simulations, and a number of field trials were undertaken to verify the channel models used in the laboratory.

Some Digital AM Objectives

The audio quality, as perceived by the listener, must be improved over that achieved by AM. The most obvious quality limitation of present AM is the audio bandwidth. AM quality is also affected by limited signal-to-noise ratio, selective fading due to multipath reception, co- and adjacent-channel interference, and interference from man-made noise and natural sources.

The DRM signal must fit within the present channeling arrangements in the AM bands, but with flexibility to permit possible rearrangements in the future. The changeover from AM to DRM will clearly be a slower process, with so many transmitters and receivers in place. At the same time, the bands are extremely crowded. So, to make the changeover possible, AM stations must be converted to DRM without upsetting or being disturbed by their AM neighbors. This implies not only that the RF bandwidth fits the channeling but also that the protection ratios (AM-DRM, DRM-AM and DRM-DRM) and the necessary carrier-to-noise ratio are inter-related.

The DRM signal should support operation of a single-frequency network. Single-frequency networks are sometimes used with AM, particularly in long-wave and medium-wave bands. But this adds distorted reception and jammed audio at the places where signals having similar strength are received from the transmitters using the same frequency. Designing a DRM system to support the single-frequency network would provide good spectrum economy.

To listen to a particular station or service in AM radio, one needs to have detailed knowledge of the band and frequency, which may change with time. The DRM receiver should insulate the listener from having to deal with the band and frequency. Suitable data transmitted along with the signal can tell the listener (via display, jingle, and speech synthesizer) the station name, tell the receiver how to find it again in case there is any scheduled change in frequency, as well as advise which alternative

frequencies may be available. It can also give some information about the future programs and their timing.

The system must offer the broadcaster the flexibility to trade intrinsic quality or data capacity against ruggedness. A local service provided by ground wave, which happens to have little co- and adjacent-channel interference, may need little protection against errors and thus it could support a high data rate. In contrast, a long-distance sky-wave service might have to cope with a large multipath delay spread, interference, and a poor signal-to-noise ratio simultaneously. The broadcaster should be able to exploit the differences and maximize the payload within the capabilities of the channel.

DRM Broadcasting: How It Works

The audio signal must first be converted to digital form. Since the raw bit-rate that results is impractically high, a form of bit-rate reduction tailored to the signal properties is then applied. This is usually referred to as "source coding."

The source-coded data is multiplexed together with any other data that forms part of the payload. (A text message alongside the audio is known as RDS – Radio Data Service. It allows a station name, song title, or even a commercial to be displayed on the front of the radio.) The multiplexed data of the payload is subjected to channel coding to increase its ruggedness. Channel-coded data is modulated onto the RF signal for transmission.

At the receiving end, the receiver first synchronizes with the signal, then performs demodulation, channel decoding (to correct transmission errors), demultiplexing of the transmitted data into component streams, and source decoding (to obtain an audio signal from the audio stream).

DRM system overview

The DRM system can be used at any frequency below 30 MHz, i.e. within long, medium, and shortwave broadcasting bands, with variable channelization constraints and propagation conditions throughout these bands. Different transmission modes are available with signal bandwidth and transmission efficiency related parameters.

Source coding

In order to achieve optimum sound quality at a given bit-rate, the system offers three types of source coding schemes:

1. **MPEG-4 AAC** (advanced audio coding), which is used for generic mono and stereo broadcasting and provides the highest quality.
2. **MPEG-4 CELP** (code-excited linear prediction) speech coding, which is used for high-quality speech coding for mono broadcasting, i.e. when there is no music content.
3. **HVXC** (harmonic vector excitation coding) speech coding for transmission of very low-bit-rate (4kbps) signals, for example, carrying a news ser-

vice accompanying the main program.

The bitstream transport format for all three source-coding schemes has been modified to meet the requirements of the DRM system. Unequal error protection can be applied to improve the system's behavior in error-prone channels. The perceptual quality of coding can optionally be improved by using the spectral band replication technology, which allows for almost full audio bandwidth of 15.2 kHz even at very low bit-rates for the coding algorithm.

Multiplexing

The DRM transmission super frame consists of main service channel (MSC), fast access channel (FAC), and service description channel (SDC). The MSC contains the actual service programs. The FAC provides information on the channel width and other such parameters, besides service selection information to allow for fast scanning. The SDC gives information on how to decode the MSC and how to find alternative sources of the same data, and gives the attributes of the services within the multiplex. It can include links to analog simulcast services.

Text messages are also possible along with audio without consuming much data capacity. The text message is a basic part of DRM and consumes only 80 bits/second. This capacity can be saved if text messaging is not used by the service provider.

Channel coding and modulation

Because of the different needs of all the channels (MSC, SDC, and FAC), different coding and mapping schemes are applied. The coding is based on a multilevel coding scheme. Due to different error-protection needs within one service, or for different services within one multiplex, different mapping schemes and combinations of code rates are applicable. The modulation method used is quadrature amplitude modulation (QAM) with 16 or 64 QAM. Quadrature phase shift keying is also possible.

The transmitted signal is organized in transmission frames with a specific duration and consists of orthogonal frequency division multiplex (OFDM) symbols. Each of the symbols is constituted by a set of carriers that are transmitted with a specific duration.

OFDM parameters must be chosen to

match propagation conditions and the coverage area that the broadcaster wants to serve. Various sets of OFDM parameters are therefore defined. OFDM parameters depend upon the available frequency bandwidth. The DRM signal is designed to work in the same broadcast bands as AM signals. Simulcast transmission of services using DRM and AM can be performed by juxtaposition of the analog AM signal and the DRM digital signal.

Protection ratio

Protection ratios are required for:

- Interference between AM and DRM signals.
- Interference between DRM and AM signals.
- Interference between DRM signals themselves.

The preliminary RF protection ratios for different channel spacing are defined. However, these values largely depend on system components; for example, on receiver and transmitter characteristics. Therefore, the values have to be considered as preliminary until measurement results and calculations are available, which are based on the performance of a broader quantity of equipment.

Service capacity

The highest achievable bit-rate for audio only is 24 kbps in a 9 kHz or 10 kHz channel. The bit-rate could be lower depending on the error protection method used, the available RF bandwidth, and error correction.

Within the currently allotted channel bandwidths (9 and 10 kHz) for analog AM broadcasting, the upper limit of the data rate available for audio is about 25 kbps under ideal propagation conditions. At this rate, even with MPEG-4 AAC coding and the SBR bandwidth extension tool, it is only possible to provide an audio quality comparable to FM mono. In order to obtain a quality comparable to CD quality, it is necessary to use an audio bit-rate of around 48 kbps. But 48 kbps, which needs a bandwidth of about 40 kHz bandwidth, will affect spectrum economy.

CD-quality audio by DRM has figured within DRM specifications, and it is intended that all consumer receivers, from the outset, will be able to support the wider bandwidth modes.

Transmitters for Digital Signals

Most of the transmitters currently in use can be modified to carry digital signals. However, it wouldn't be cost-effective to modify the older transmitters, so these need to be replaced with new DRM-capable transmitters that will retain the capability to transmit analog AM, if required.

The AM transmitter is simply converted to provide digital modulation. Since all the AF and RF sections of the transmitter remain substantially unmodified, the broadcaster can easily revert back to analog AM, if necessary. Also, digital transmission doesn't require carriers and considerable power can be saved.



Digital transmissions on longwave is being tested from this site at Ingoy, Norway

There are numerous types of AM transmitters in service – some very old indeed. A majority uses some variety of high-level modulation, whereby the amplitude of the RF signal is modulated by varying, in effect, the power supply to a non-linear RF amplifier (class-C mode).

A digitally modulated signal can be considered to be equivalent to a phase-modulated signal of constant amplitude, which, in turn, is also amplitude-modulated. Such a signal can be smuggled through an AM transmitter structure by separating the signal into its amplitude-modulated and phase-modulated components. The amplitude-modulated signal simply takes the place of previous audio modulation input, while the carrier-frequency input (normally derived from a synthesizer or other stable frequency source) is replaced by the phase-modulated RF signal. The bandwidth of the amplitude-modulated signal in this arrangement is greater than that of the audio signal it was designed for. In addition, the modulator must work down to zero frequency. In some cases the modulator would have to be replaced to achieve this, while in others it may be sufficient to modify a filter.

Key Technologies Behind DRM

COFDM

COFDM stands for Coded Orthogonal Frequency Division Multiplex. That is the combination of signal coding applied to an OFDM modulation scheme. OFDM is a spectrum efficient signal modulation scheme which employs a number of equally spaced carriers to carry a digital bit-stream. If the original data is considered as a serial sequence of bits, then the transmitted OFDM signal may be considered as a parallel bit stream. The incoming serial bits are split across the transmitted carriers so that the bit-rate per carrier is roughly the incoming bit-rate divided by the number of carriers.

The carriers are arranged on an equal frequency spacing, where the spacing is equal to the inverse of the active symbol period of the data applied to the carrier. If we consider the energy density against frequency for a single modulated carrier, it will have maxima and minima of energy which will extend either side of the carrier center frequency. If we shape the symbol pulse suitably, we can arrange for the energy density peaks to reduce rapidly at frequencies which are a few carrier spacing distances above or below the carrier. By arranging for the symbol period to be the inverse of the carrier spacing, we ensure that the minima for any carrier lies on the center frequency for the adjacent carriers.

The effect of this is that the energy density of one carrier is at a minimum for all close carriers where its energy density remains significant. In this way we reduce to a minimum the inter-symbol interference which could occur between adjacent carriers.

The ability of the transmitted COFDM signal to withstand the effects of multi-path propagation is further improved by the addition of a *guard interval* between every transmitted symbol. This significantly reduces the sensitivity of the signal to the delay spread resulting from this

multi-path.

MPEG4 AAC

MPEG4 AAC is a development of the audio coding techniques used in MPEG2 (Layers I-III), though it is not backwards compatible with MPEG2 coding. MPEG4 AAC is at least twice as efficient in its use of data capacity as MPEG2 Layer III (also commonly known as MP3), the previously most efficient audio coding system available. MPEG4 AAC is able to achieve a subjective quality, at 48kb/s, similar to that of FM stereo. At about half this data rate with the addition of *SBR* (see below) it can achieve a subjective audio quality comparable to FM mono.

MPEG4 AAC provides a general purpose audio encoding/decoding process designed to deal equally well with all types of audio material, whether containing speech or music. As with previous general purpose MPEG audio codecs, it uses transform coding to analyze the spectral energy content of the audio signal and uses knowledge of the masking effect of the human hearing mechanism to remove the lower level components of the audio signal which will be masked by the higher level components of the signal.

MPEG4 CELP

MPEG2 audio codecs use only transform coding and make no assumptions about the content of the audio. MPEG4, on the other hand, supports not only general purpose audio coding, using an advanced transform coder called AAC (Advanced Audio Coding), but a CELP (Code-book Excited Linear Prediction) algorithm, which performs well for coding speech waveforms, but poorly for coding musical material.

The reason for the introduction of a CELP speech coder into the MPEG4 specification is that the performance of AAC deteriorates when coding speech at the lowest bit-rates (e.g. < 14 kb/s). At bit rates significantly lower than this, a dedicated speech codec provides significant quality advantage and can be used down to rates as low as 6kb/s with adequate quality (but not a quality to be considered close to FM mono) and intelligibility. Since MPEG4 CELP was designed as a speech coder, it provides an audio bandwidth which is designed to deliver intelligent speech rather than hi-fi speech. This bandwidth limitation can be overcome and the speech quality enhanced by using the *SBR* tool.

SBR

SBR is a bandwidth enhancement tool, which works co-operatively with a primary audio coding system to enhance the perceived audio bandwidth. In the case of the DRM system, the *SBR* tool has been designed to work co-operatively with both MPEG4 AAC and MPEG4 CELP.

In most current audio coding systems aimed at the consumer market, and which are designed to reduce the audio coding bit rate, the most computationally intensive part of the system is the encoder, whereas the complexity of the decoder is intentionally minimized. This arrangement made good sense when the cost and power consumption of powerful digital signal processors (DSPs) was too high for widespread adop-

tion in consumer products. This position is rapidly being reversed with the availability of powerful consumer DSPs. *SBR* takes advantage of this opportunity by requiring that the most intensive processing is required at the decoder.

Guard Interval

In order to increase the immunity of OFDM system to multi-path, a guard interval is added to the transmitted symbols. This guard interval extends the length of the transmitted symbol. However, the window length used in the demodulator to decode is that of the active symbol, which excludes the guard interval time.

This means that symbols arriving later than the first (due to reflection paths of differing lengths), but no later than the guard interval time, will still be seen as having the same value within the demodulator window. The result is that the later arriving symbols, provided they are not delayed longer than the guard interval, will add constructively to the received energy, whereas symbols which are delayed longer than the guard interval will have a destructive effect. The degree of the destructive effect will increase proportionately with the amount by which the delay in arrival time exceeds the guard interval.

In the DRM system, the guard interval is changed depending on whether the expected primary propagation is by sky-wave (long guard interval) or ground-wave (short guard interval). Increasing the guard interval reduces the data capacity of the system, as there is a reduction in the available time for active symbols, and therefore the number of symbols per second.

DRM receivers

The first consumer digital AM receiver is proposed to be available in May 2003, the same time when DRM services will commence. At present, there is no off-the-shelf DRM-capable receiver. However, software-defined radios such as the WiNRADiO 303i, combine a receiver front-end with the processing power of your PC. The receiver front-end brings the received signal down to a frequency low enough for the PC to be able to process it. DRM software will soon be available from WiNRADiO with no receiver modifications required.

DRM is also looking to provide a software-based DRM receiver that will work in conjunction with a suitable communication receiver. This communication receiver would form the front-end of the digital AM receiver.

The digital receiver will require the use of:

1. A good-quality receiver at the front end with 9 and/or 10 kHz IF bandwidth, depending on the band and region for mediumwave band.
2. A downconverter to convert the existing final IF frequency of the receiver, say, 455 kHz, down to 12 kHz.
3. A 300 MHz PIII PC (minimum), with a good-quality sound card that supports a sampling frequency of 48 kHz, running Windows 98 or 2000.
4. The receiver software, along with instructions, etc. When the 12 kHz IF signal from the downconverter is connected to the analog input of the sound card in the PC, the PC software will provide the necessary facility to demodulate and demultiplex the DRM sig-

or "USB One" USB Audio Interface. Notebook soundcards are not always compatible, and a compatibility list will be published.

- LAN network driver or dial-up network installed
- Suitable front end with 12 kHz IF output, output level suitable for soundcard
- A front-end receiver is also required, an AOR7030 or another receiver which can be modified. The modification is the addition of an extra circuit board to produce an extra Intermediate Frequency (IF) of 12 kHz. Several companies already sell these conversion boards.

The DRM signal is received by a commercial long, medium, shortwave (SW, MW, LW) front-end. Any front-end should be usable which can provide an IF of 12 kHz directly or with an adapter circuit. The bandwidth must be greater than 10 kHz for normal transmissions and greater than 20 kHz for transmissions with channel bundling.



This signal is then fed into a standard soundcard. The soundcard must offer a sampling rate of 48 kHz. For output of the audio signal a soundcard with a sampling rate of 48 kHz is also required. If one sound card is used for both sampling the signal and output of the music, the soundcard must provide full duplex operation. Most of newer soundcards provide all these features (e.g. SoundBlaster Live! from Creative Labs). Attention must be taken not to use an input with AGC (Automatic Gain Control) as this disturbs the DRM signal.

DRM Test Transmission Information

Only those with a DRM test receiver will be able to actually resolve the transmitted OFDM digital signals and decode the digital au-

dio or test signals that they contain. If you tune into a DRM transmission, while it is in the digital part of the sequence, then you will simply hear what sounds like a very high level of noise in the channel. You should not be able to hear any obvious structure to the signal, since the data is deliberately scrambled by removing any identifiable or periodic characteristics – not to make it encrypted, but to make it as much like noise (i.e., random) as possible. This scrambling process is standard in almost all digital transmission systems.

There is an exception to the above: the period in which a channel sounding sequence is being transmitted. This particular sequence does not use any of the DRM transmission modes, and when heard on an analog receiver it will have a more unpleasant rasping sound. The sequence is inserted specifically to allow an accurate profile of the transmission channel to be obtained. It is used only for test purposes and would not be transmitted as part of an established DRM service.

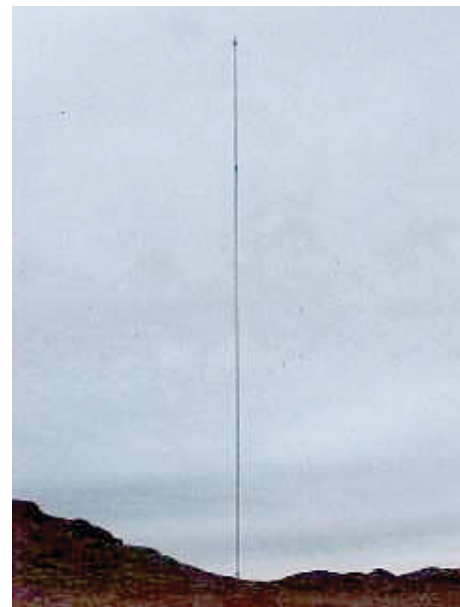
Some long-term testing started in 2002, and the current schedules are posted in this DRM part of the Media Network website. If you're interested in more detailed information than we can give here, try <http://www.drm.org> – the official web site of the DRM consortium.

DRM test transmissions are taking place from the longwave site at Ingoy close to North Cape in Northern Norway. The frequency is 153 kHz, and the power 100 kW. Broadcasts are scheduled Monday through Saturday at the following times UTC, with AM and DRM modes alternating, and also simulcast mode (AM and DRM at the same time):

0805-0900
0905-1000
1205-1300
1305-1350
1405-1500
1805-1800
2115-2200

For more information on the Ingoy longwave site, see <http://dxlc.com/longwave/ingoy.html> for background info and photos.

The DRM web site should provide you with some information about the testing program and schedule. You will also find links to the web sites of DRM Members and additional information. Due to the nature of the testing process, there will always be late changes or additions to the testing schedule, so the published information may not always remain up-to-date. Of course, without the appropriate DRM test receiver it will only be possible to resolve those



parts of the test transmissions which use analog modulation.

In general, DRM test transmissions will start with an announcement that uses analog AM and will contain short sections of both analog and digital transmissions so that comparisons can be made between the performance of the digital and analog systems. Normally the same channel and transmitter is used for a 30-minute test transmission, so that the propagation channel remains as similar as possible for the two types of transmission.

AM – Alive and Still Kicking

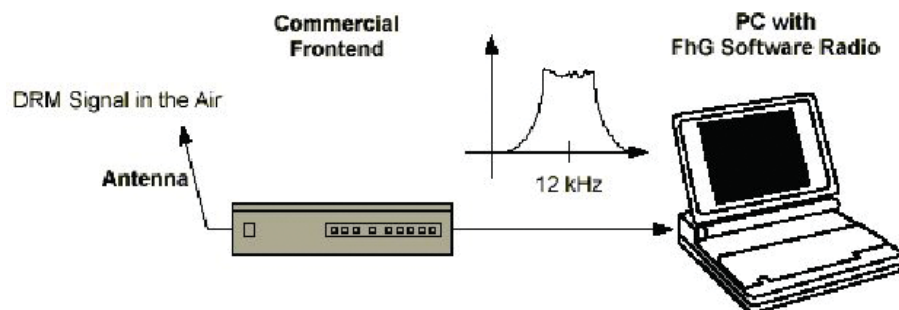
Shortwave, together with medium and longwave broadcasting, still has a large audience worldwide. However, the number of people listening to the programs is in decline, and could be expected to go lower in the future simply because of poor audio quality and reception conditions.

The newly developed digital system DRM will overcome these reception problems and introduce high audio quality, which will bring this type of broadcasting to a level similar to local FM today. It's now possible to envision a future in which the listener will not have to know the frequency in order to tune in. All he will have to know will be the name of the station he wants to listen to. Reception quality will no longer be a factor in determining which program he can listen to – just the program quality itself.

REFERENCE

1. DRM website - <http://www.drm.org>
2. European Telecommunications Standards Institute: Digital Radio Mondiale (DRM), *System Specification ETSI TS 101980*, 2001.
3. DRM Software Receiver and Multimedia Services - Fraunhofer-Institut für Integrierte Schaltungen IIS - <http://www.iis.fhg.de>

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The Dummy's Guide to DRM

By Lee Reynolds

Lee Reynolds may be the first hobbyist in the US to decode digital shortwave signals, or at least to report doing so. MT is honored to publish his initial impressions - ed.

Okay, so you've read the preceding article on DRM and the task has proven to be an intriguing, if somewhat mystifying diversion. So, what does DRM sound like on the air, how do you decode it, what does it sound like when it's decoded and what does it *really* mean for you and for the hobby? Here's my take on it derived from my experimentation with the mode so far -

DRM is an interesting means of transmitting audio and other data in fairly low bandwidth digital format on shortwave. "Low bandwidth" is a relative term; you're looking at a 10 kHz (minimum) chunk of bandwidth per broadcaster. What it sounds like on the air using an ordinary SW receiver is noise - wide band noise. Nothing more. You may even think you're on an empty channel listening to the normal background hiss until you happen to note that the S-meter on your radio is indicating a signal level of S9+50dB. That's a DRM signal there, buddy!

If you want to hear a DRM signal for yourself, RCI and CBC Transmissions are running test broadcasts of the BBC World Service from Sackville every evening on 6010 kHz from 0000-0100 UTC (target: USA East) and 0400-0500 UTC (target: USA West).

(...And to think we thought that the BBCWS was no longer broadcast to North America on shortwave!)

At present there's only one *easily* accessible (to us regular folks who aren't governments or broadcasters and who have to hold down real jobs!) route to receiving a live DRM signal that I am aware of - using a radio that can provide a 15 kHz wide signal output at a center frequency of 12kHz feeding a sound card in a PC running DRM decoding software.

Think of that signal from the radio as being like an IF output signal except that it's at a somewhat lower frequency than they usually are (455 kHz is a typical example.) Decoding software for DRM has been available for a number of weeks now and comes in commercial (available from Merlin, amongst others) and freeware (compile-it-yourself) versions. So, radio -> 12 kHz signal out -> Soundcard -> software -> speakers! It's really not so very different from using something like PC-ALE or JVFX to decode other digital modes.

I've always been a bit of a hardware tweeker by inclination as well as a long time digital utility monitor, so when I found that the DRM decoding software was finally available I decided to see if I couldn't perhaps do

something about receiving DRM. Some research on the Internet indicated that I had a couple of receivers in my possession that might be modifiable to provide that necessary 12 kHz output - the Ten-Tec RX-320 and the JRC NRD-525. AOR UK's web site even suggested that the RX-320 might be *very* easily modified to do the job!

Well, to cut a short story shorter, a few caps, a piece of wire and an RCA phono jack later (along with judicious receiving tests before I made any permanent mods), and I had a DRM-capable RX-320 on my hands. I'd purchased the DRM decoding software already and had checked it out during the '320 mod testing stage. I was now the owner of a DRM receiving setup.

How does it sound? Well, it's quite reasonable. You'll get good wide-frequency audio out of the signal with no fading or background noise. It's actually a bit like the audio you get on the BBC World Service channels on the Sirius and XM satellite radio services. It's not FM quality, quite, but it's a lot better than the old-style AM SW reception we all know and love! Plans are afoot to greatly increase the frequency response on the 0000 transmission to 18 kHz, from <=7kHz, probably by the time you read this article. Dropouts (a digital equivalent to fading, if you will; I don't want to go into bit rate errors here) cause the audio to momentarily echo or go silent.

There's an old saying about making lemonade "when life hands you lemons" - well, it's applicable here. Whether we, as shortwave hobbyists, like it or not, DRM may well become the preferred delivery method for shortwave programming in the near future. Instead of complaining about DRM we should be checking out this new kid on the block and getting ready for it. Yes, it's going to make the BC bands real noisy, yes, I have a strong suspicion that a weak DRM signal is going to be a lot harder to recover good audio from than that weak analog signal from Nibi-Nibi, yes, it's a change and a challenge...

...On the other hand I have never before heard a signal from the BBC that just IDed itself on my computer screen, I've never sat and watched all kinds of interesting digital diagnostic data on a shortwave audio-bearing signal like this, and I sure as heck haven't seen a signal from the BBCWS before that could potentially, if so desired, deliver a QSL in JPEG format to me while I listen! If the broadcasters start using DRM's additional multimedia and data transfer abilities with imagination and style, we're *all* going to have some fun.

Just think, no more wondering which relay that signal's coming from - it told you in black and white on your computer's screen...and it just downloaded the upcoming season's frequency schedule to your computer!

DRM - give it a try, you may surprise yourself and actually enjoy the experience!

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The EH Antenna – Exceptional or Hype?

by Bill Prudhomme, KF5PQ
kf5pq@bellsouth.net

While searching the Internet recently for information on antennas, I came across a website that caught my attention. The description stated that “for over 120 years all antennas (except the cross field antenna) have been Hertz antennas. In the future, all antennas will be EH antennas.”

I was intrigued. How could such a bold statement be made? After all, traditional Hertz type antennas (dipoles, verticals, etc.) have been around for a long time and have served us very well. I began to ask a few questions: Why change now? What is an EH antenna and what’s so different about it? How does it work? How well does it perform? Does EH stand for extreme hype or exceptional hit?

Thus began my journey to learn more about this new development and determine where the EH fits in our world of conventional antenna designs.

The Conventional Hertz Antenna – A Brief Review

In order to understand how the EH differs from conventional antennas, we need to first review some basic concepts about the traditional Hertz antenna. Transmitting and receiving antennas today operate on principles first discovered by the early pioneers in electric and magnetic field theory. In the mid-1800s, A. Ampere, M. Faraday, and K. Gauss individually discovered different aspects about the behavior of electric and magnetic fields. Later, James C. Maxwell, a Scottish mathematician, pulled all the pieces together to develop his four famous equations that describe electromagnetic wave propagation.

Maxwell’s equations remained theoretical for several years until 1888. In that year, Heinrich Hertz devised a simple experiment that demonstrated the propagation of electromagnetic waves and thereby confirmed Maxwell’s equations. Today, in honor of Hertz’s contribution, the unit of frequency (cycles per second) is called the “Hertz,” and conventional antennas which operate on the principles derived by Maxwell and demonstrated by Hertz are referred to as “Hertzian” antennas. These antennas, which have been used and studied for over a century, are the mainstay of modern wireless communications. So just how do they work?

We know from Ampere’s experiments that when an electric current flows in a wire, a magnetic field is generated around the wire in a circular direction around the path of the moving elec-

tric charges (electrons). Similarly, if we apply an alternating electric current, a corresponding alternating magnetic field is produced. This phenomenon also works both ways: a time varying electric field produces a time varying magnetic field and a time varying magnetic field produces a time varying electric field. Now let’s apply this principle to a conventional Hertz antenna, the dipole.

When a radio frequency (RF) source (at the resonant frequency of the antenna) is applied to the feed point of the dipole, the antenna appears as a resistive load to the RF source and almost all the current flows in the antenna wire. This alternating electric current produces varying electric and magnetic fields, which extend out from the antenna in an area known as the *near field*.

In order for radiation to occur, however, the electric and magnetic fields must be in time phase and perpendicular to each other. For a Hertz antenna, this doesn’t occur until the fields are approximately 1 to 2 wavelengths out. At this distance from the antenna, generally referred to as the *far field*, the electric and magnetic fields become orthogonal (that is, at right angles to each other) and the wave front travels away from the antenna in a direction perpendicular to the orthogonal electric and magnetic fields. Briefly, that’s how a conventional Hertz antenna radiates.

While large conventional antennas have served us well over the last century, the need for small, highly efficient antennas has been steadily increasing. To date, attempts at designing antennas with a small footprint have met with marginal success. One major problem is that, as a Hertz antenna is reduced in size, it is no longer resonant at the desired frequency. For example, a dipole that is cut shorter than a half wavelength exhibits a high capacitive reactance.

In order to make it resonant at the desired frequency, we must introduce inductive reactance to cancel out the capacitive reactance. While this allows the antenna to resonate at the frequency of the RF source, the small Hertz antenna still does not radiate or receive very efficiently. The EH antenna attempts to overcome this shortcoming in a very unique way, which we will see in the next section.

The EH Antenna Defined

The EH antenna was developed several years ago by Ted Hart, W5QJR, and he has been granted a U.S. patent (US 6,486,846 B1) with additional filings pending in other countries. Commercial broadcast versions of the antenna are being developed by the inventor and tests are being conducted to confirm the claims. Meanwhile, he is making royalty-free design details available to anyone who wants to build an EH antenna for personal, non-commercial, experimental purposes. Although this article is not intended to describe how to build an EH antenna, we’ll look later at one possible design with references to obtain additional information on how to build one.

What exactly is an EH Antenna and how did it get its name? According to documents published by the inventor, “the EH Antenna is nothing more than a Hertz antenna driven with a phase shift network that allows radiation to occur at the antenna, with associated benefits.” It is the phase shift network that is at the heart of this development. This seemingly simple concept has been causing a buzz in the antenna community as we all attempt to understand how the circuitry works.

Some of the claimed benefits of this antenna design include:

- **Compact size** – Typical sizes are about 2 percent of resonant wavelengths. For example, an EH antenna built for 40 meters is less than 3 ft long. So it’s small, lightweight, and can be mounted in inconspicuous locations.

EH feature continued on page 82

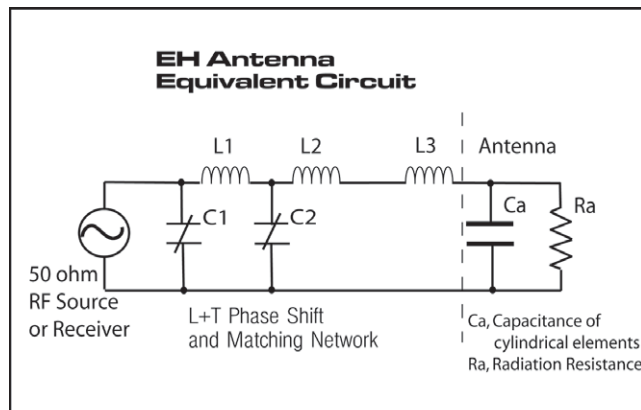


Fig. 1 – Equivalent circuit of the EH antenna with the L+T Phase Shift/Matching Network.

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Join the Club: A Look at the ARRL

For years I've been referring *Beginner's Corner* readers to the magazine *QST* and the American Radio Relay League (ARRL) web site on various topics of information pertinent to newcomers to the hobby. And now, for the benefit of *MT*'s beginners, I'll answer some of the more frequently asked questions about the League: Exactly what is the ARRL? Do you have to be a ham to belong? What else do you get for your membership besides a monthly magazine?

❖ First, a Little Radio History

The concept of "wireless telegraphy," which is how radio was described in the early days, had gripped the country with an excitement for technology eclipsed only by the computer craze of the '80s and '90s. In the early years of the 20th century, articles on the subject appeared in magazines as diverse as *Harper's Weekly*, *Atlantic Monthly*, *Cosmopolitan*, and, *Women's Home Companion*. There were hundreds of local radio clubs with thousands of members all meeting regularly and sharing information about what they were building and what they were hearing. Many daily newspapers featured radio columns which detailed construction techniques and radio theory as well as reception reports. Most commercial stations began, and many continue today, to send verification cards (QSLs) to listeners whose reports they receive.

The ARRL has roots in the radio hobby dating back to those early days. Since 1915 the League has been the premiere organization for radio enthusiasts around North America and the world. But, in the earliest days, station equipment was relatively primitive (Morse code via spark gap transmitters) and contacts were confined to the lowest frequency band (200 meters) with propagation to fairly short distances. For years radio operators, both on land and sea, would relay messages when the intended recipient was too far from the originating station. As an example, the Central Radio Association, which was formed in 1911 and had grown to several hundred members by 1914, was relaying messages for its members from the Rocky Mountain states as far east

as Ohio.

At that time millionaire inventor Hiram P. Maxim was operating a 1 kW spark gap amateur station with the call sign 1WH out of Hartford, CT, and was looking for a way to quickly relay messages across the country. What was needed, he believed, was an organized group of operators who could be relied upon to receive and relay the messages accurately and without delay all the way across the continent. After incorporating in the state of Connecticut, the new American Radio Relay League issued to its members a 40-page operating booklet (complete with 8 maps and 50 message blanks) for a 50-cent fee which was optional. All League members would be listed in the "call-book"; however, participating stations choosing not to cough up the 50-cent fee would be so designated. By the end of 1915 there were 600 stations listed.

In December of that year each League member was mailed a copy of a 16-page magazine called *QST*. Those letters were part of the amateur radio "Q-code," a way to designate a common message phrase using a combination of three letters all beginning with Q. *QST* means "calling all amateur radio operators." The magazine was being published privately by Maxim and the former secretary of the Hartford radio club and would be available to League members by subscription for \$1 per year. Eighty-eight years later the ARRL has around 160,000 members and *QST* runs 160 pages in length and costs \$39 per year.

❖ The League Today

The ARRL strives to answer the needs of hams across the U.S. The breadth of discussion in the pages of *QST* might be enough to do that and still have a sense of accomplishment, but that's not the how the League sees it. In addition to publishing the



Monitors and console which control all of the WIAW bulletin transmitters. Thousands of hams around the country tune in daily for news, propagation forecasts and DX reports from League HQ. (Courtesy: ARRL)

magazine and a host of radio-related books, from license manuals to light fiction, the League represents the entire amateur radio community in legal issues involving amateur radio at the local, state, national and international levels. The ARRL has always enjoyed close relations with the FCC; in fact the Secretary of the Department of Commerce, which oversaw all radio regulation in 1920, was Herbert Hoover, himself a ham.

Today League members can receive information on a range of regulatory issue such as zoning restrictions and reciprocal licensing (being able to use your ham radio privileges abroad). They offer a Volunteer Examiner Coordinator program, sanctioned by the FCC, which provides registered amateur radio instructors and allows testing at all license levels. They provide daily Morse code practice sessions, ham related news bulletins and code proficiency sessions via their widely heard transmitters at WIAW, the League HQ station in Newington, CT.

But wait, there's more! The League organizes and sponsors operating contests for every band, mode and license class as well as offering awards for long-time operating achievements such as DXCC (worked, and verified, at least 100 countries). They operate an "Outgoing QSL Service" which makes sending quantities of QSL cards to foreign countries a tenth or less the cost of sending such cards via first class post.

And, finally, the League offers special access to their "members only" web pages which



ARRL logo (Courtesy ARRL)



Spark Gap Transmitter (left) and post WWII 1 kW transmitter (right) built for W1AW. Just a few of the artifacts from the rich historic tradition of amateur radio on display at League HQ. (Courtesy: ARRL)

include the ARRLWeb Extra on-line magazine; access to their Product Review Archives (where you may retrieve copies of any *QST* Product Review column from 1980 to present in PDF format); do an index search of all issues of *QST* and *QEX* (the ARRL Forum for Communications Experimenters); and use the ARRL e-mail forwarding service (using the @arrl.net address). You can even get free e-mail delivery of a host of specialized on-line weekly publications such as the latest propagation forecast, digest of AMSAT news, and a weekly amateur radio bulletin. That \$39 goes a long way!

◆ How To Sign Up

The good news is that you don't have to be a licensed ham to join the ARRL and receive *QST* magazine (however, only licensed hams can vote in League elections). Anyone with an interest in radio can join. There's been a significant effort in recent years to court the new "codeless Tech" operators with basic columns geared at new entrants to the hobby and many reviews of products of interest to new hams.

If you'd like to see a copy of *QST* to preview the magazine, send a check for a couple of dollars to cover postage to the address below. You can join on-line by going to their web site



Just one of many operating positions available for use by visiting hams at League HQ. This is "Studio 3" and is for all the latest digital modes. (Courtesy: ARRL)

<http://www.arrl.org>, calling 860-594-0200, or writing them at The American Radio Relay League 225 Main Street, Newington, CT 06111. A one-year membership is \$39, but, if you're 65 years of age or older it's \$34. A two-year membership is \$74 or \$65 for seniors, and a three-year membership is \$105 or \$92 for seniors. In addition, a member of the immediate family of a League member, living at the same address, may become a League member without *QST* subscription for \$8 per year (family memberships must run concurrently with that of the member receiving *QST*). If you are under the age of 21, residing in the U.S. and possessions and

the oldest licensed Amateur in the household, you are eligible for a reduced rate. Contact the *QST* phone number for more information.



ARRL DXCC Certificate shows that the named ham has worked and verified 100 countries. (Courtesy ARRL)

Finally, a couple of words about League membership. When you see your first copy of *QST* don't be alarmed if there are many articles inside which seem to go over your head. Remember, the magazine is intended for *all* hams, which includes some extremely knowledgeable and very competent people. If you stick with it long enough you'll be surprised at how much you can learn by just reading and trying to understand what's going on. You should just consider it to be part of your on-going radio education.

You may not need all the services the League provides, but, when you do, you'll be glad they're there! Are all hams members? No. Are all members satisfied with how the League functions? No. Is there room for improvement? Yes, and you can be part of the improvement because it will be *your* organization when you join. You may find yourself participating in the VEC program, running for Section Manager or even writing articles for publication – it's all up to you!

◆ How To Tune In!

For daily news about amateur radio, including DX operations, regulatory issues, space operations and propagation information, tune in W1AW's voice bulletins at 9:45 pm ET (8:45 CT, 7:45 MT and 6:45 PT) on the following frequencies: 1.855, 3.990, 7.290, 14.290, 18.160, 21.390 and 28.590 MHz.

In addition to voice transmissions, W1AW also offers the same information in Morse code (18 wpm) on the following frequencies: 1.818, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 MHz. CW bulletins start at 5:00, 8:00, and 11:00 pm ET. Radio Teletype bulletins are sent as well as Code Proficiency Qualifying runs at speeds up to 40 wpm (see the W1AW schedule on the League web site for details).

One thing I have occasionally noticed is that, following the voice bulletin, you may be able to work W1AW as the operator sometimes hangs around the frequency following the bulletin. If you miss that, you may be able to catch visiting hams who are allowed to use the facilities at W1AW, from 10 a.m. ET until Noon and from 1 p.m. until 3:45 p.m. Monday through Friday. To take advantage of the chance to operate W1AW bring your license or a copy of it with you to the HQ.

To learn more about amateur radio history you can read Clinton B. DeSoto's *200 Meters & Down*, a League publication first published in 1936, still in print and available from League HQ. Many of the above historical notes were taken from DeSoto's book.

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More on S Meter Scales

In a previous column, we pondered why signal strength meters on shortwave receivers have a scale that goes to S9; why not 10? One reader suggests that it was based upon the traditional RST (receivability, signal strength, tone) "599" qualitative reporting system used by CW (Morse) operators which went from 1-9 for signal strength. (See Q&A below)

Michael Tracy, KC1S, from the American Radio Relay League (ARRL) concurs, adding:

"...the 6 dB per S-unit wasn't 'standard' until Collins defined it. The April 1939 article on checking beam antenna patterns examined the S-units of several popular receivers of the era and found them all to be different.

"Some of the pictures of early S meters showed that they lacked any kind of markings above S9 (instead, the meter had a 'redline'), so it seems that the dB markings were added later; and the reason they didn't use 6 dB increments is that S-units were not standardized at 6 dB yet."

Michael went on to note that even now, S meters on receivers and transceivers are notoriously inaccurate. But they do provide valuable comparative readings for experimentation and qualitative signal reporting.

Dick Holbert, K2HZ, adds this:

"S9 was supposedly set at the point of the 'knee' in the receiver AGC curve where further increase in signal would not significantly increase the audio output. The range between this point and an unreadable signal would be about 50-60 dB, so dividing the range into 9 units resulted in 6 dB [increments].

"Above S9, most receivers could handle signals up to an additional 40 dB or greater, but since the RST scale no longer applied, and there was little audible improvement, a 6 dB scale no longer was appropriate. The top of the scale was then +40 and an intermediate point at +20 was indicated with 10 dB marks in between."

And Doug Robertson, a former bioacoustical engineer, concurred with the findings above, and provided yet more insight. He forwarded a chart of S units vs. microvolts (S9 = 50 microvolts into 50 ohms = -73 dBm), and said that the 10 dB increments above S9 were chosen because human hearing at normal levels judges this amount of audibility as "twice as loud" (the traditional Fletcher-Munson curve).

Thanks, Michael, Dick, Doug, and the rest of our skilled readers who followed up on this question.

Another Question for Our Readers:

Several listening hobbyists have complained of "hash" interference from electronic appliances even when they are turned off. Most notable was a Panasonic 13" TV (model CT13R17B) that had

a harmonic-rich, warbling carrier that started at 185 kHz and was heard all the way into the HF (shortwave) spectrum. Another offender was a digital cable system for TV and Internet.

Pulling the AC plug on these devices solves the problem, but that shouldn't be required since they come with on/off switches, and they shouldn't be generating interference to begin with!

How about, readers? Have any of you had experience with these new devices? What are their causes, switched power supplies? And will a simple ferrite-bead filter on their cabling cure them?

Q. *I either read or saw in a movie the phrase "I hear you five by five," apparently meaning "loud and clear." What is the origin of this expression? (Lance King, email)*

A. In the early Morse-code days of radio, a standard list of abbreviations was adopted to speed up the exchange of information. Signatures of "73" and "88" meant "Best wishes" and "Love and kisses;" Q codes like QSL and QRM ("Message received," "You are being interfered with") were devised for signal and messaging information.

Numbers 1 through 5 rated the Quality of the tone and Receiving conditions; Q1 R1 meant that the tone quality was dreadful and receivability was impossible, while Q5 R5 meant that the quality of the Morse tone was excellent and the receiving conditions were excellent. This is the origin of the slang "Five by five" adopted by some two-way voice communicators.

The Q5R5 table was eventually replaced by the RST (Receivability, Signal strength, Tone) system which would be optimum at 599.

An even-more-recent slang has evolved among voice communicators: the phrase "Lima Charlie," phonetics for L and C, meaning "Loud and Clear."

Q. *Can a military truck antenna be modified to be used on CB? (Lee Alessi, email)*

A. It depends on the length of the military whip. CB is 27 MHz, so you need either a full-quarter-wave 27 MHz whip (approximately 106 inches), or a shorter antenna that has a loading coil on it to make it resonant at 27 MHz. Both are readily available from Radio Shack as well as CB shops.

I guess you can always spray-paint it olive drab and no one will ever know!

Q. *By removing the whip on my truck and replacing it with a long wire antenna, will I have the directional Beverage effect? (Mark Burns, Terre Haute, IN)*

A. Not unless the antenna is about 1/4 mile long, parallel to and about 12 feet above the ground, and terminated at the far end with a resistor (400-600 ohms).

Q. *Do "wall warts" (AC adaptors) ever catch fire? (Sterling Marcher, La Mirada, CA)*

A. Like any other electrical accessory, there is always a possibility for a short circuit in the cable causing overheating. In the better-built units, fusible links in the transformers act as fuses, opening a winding when excessive heat is present, effectively turning off the adaptor. We had a cheap, unmarked AC adaptor blow up like a firecracker in our test lab not too long ago, showing a visible flame which then went out.

Products bearing the Underwriter's Laboratories (UL) seal have met certain failsafe standards and are less likely to cause a problem.

Q. *The memory-backup battery on my ICOM R71A is dead, and I've lost all control for the receiver. Does anyone specialize in doing the replacement and reprogramming of the RAM card? (A Humphrey, Canada)*

A. Yes, ICOM does. They maintain a web page for the lithium battery replacement procedure at http://www.icomamerica.com/support/documents/ram_card.html, but instruct the owner to send the radio to them for reprogramming if the power has been lost.

Questions or tips sent to Ask Bob, c/o MT are printed in this column as space permits. If you desire a prompt, personal reply, mail your questions along with a self-addressed stamped envelope (no telephone calls, please) in care of MT, or e-mail to bobgrove@monitoringtimes.com. (Please include your name and address.) The current Ask Bob is now online at our website: <http://www.monitoringtimes.com>

32

Another knock on the door has brought another headache. My friend, we will call him Jason, brought over his new Yaesu FT-817, a micro HF/VHF rig. Naturally, he wanted a modification done for it. If you look it up at <http://www.mods.dk>, you will see that it is a difficult mod, made even more difficult by the fact that different hams report different approaches to the process. I opened up the radio, and quickly recognized a botched job. Jason had attempted the mod and screwed it up. Neither all the King's men nor Gary could fix this! Now he will pay a steep price for his tinkering. The bright idea: unless you are a skilled, and knowledgeable technician, or hobbyist, please don't even consider opening up a radio.

33

Soldering is a very useful expertise. It is an acquired skill, and requires patience, as well as a steady hand. If you have little or no soldering experience, start with an easy task. Solder a 1/8 inch male connector to that old speaker in your junk box. You can make up some "extension cords" for DC applications using the red/black Anderson Power Poles. They are readily available in packages of 10 from several internet vendors. These DC connectors are rapidly becoming the standard in the amateur radio world. Practice soldering on an old PC board, or just soldering wires together.

In the February 2003 issue of *MT*, Bob Parnass details a fairly simple mod on page 79 for the Pro92/2067 radio. Ask a qualified friend to be your mentor. Remember to learn to use a Multimeter to check for short circuits, etc.

34

Speaking of soldering irons, I keep one in my "Go Bag" in case I run into a sudden repair job. I cut a length of soldering braid, and a length of solder. Using a wire wrap I attach these to the cord of the soldering iron. Now they are always ready as a complete tool. I found an old cigar tube, and placed even more braid and solder in it. Always the worry-wart, I carry another set of these materials in my vehicle tool box. You can never have too much of either. On my shop bench, I keep both rolls right next to the soldering iron. When I can't find them, I know it is time to completely reorganize the bench top!

35

I probably own two dozen radios that are programmable via a computer. I have hundreds of hours invested in those files! I spent a lot of time this winter updating and adding new files. In addition to the local list of frequencies, I have all the files for general public safety, my special "Wildland Fire," and general "Travel Trip" with FRS, etc. You never know when that hard disk is going to crash, or be the victim of fire, theft, etc. To back up all my frequency lists and databases for all my programmable radios, I use a 100 megabyte Zip™ drive. I store it in my fireproof document box. On second thought, I'd better make an extra copy, and store it at my brother's house.

36

I have mentioned the British manufacturer SSE for their unique, solidly built metal radio stands and specialized aircraft band antennas. Those Brits are really into air band monitoring!

I am trying out their new Adjustable Audio Filter (AAF-2002.) Wow, a great little gadget! If only it had a couple of LEDs. It does make really great sounds from a radio like the VR-5000, which has the speaker on the bottom. (What was Yaesu thinking?) Looks like a keeper in the radio room. Check out their website at <http://www.ssejim.co.uk>. See the photo.



Yes, I am showing off my new Yaesu VR-5000 purchased from Grove Enterprises. With a \$400 dollar coupon plus a free DSP, how could I pass this up? Note the Lockout key on the scanner with whiteout applied for quick reference/action.

37

As a kid, I spent much of my time listening to radios and reading books. What else are you going to do if you live in a small town? Well, I still enjoy both activities. I seem to have hundreds of books. Some of my most cherished and useful books came from the fine library at ARRL. You can visit their store at <http://www.arrl.org/catalog/> or call 1-888-277-

5289. The ARRL *Operating Manual and Handbook 2003* are my basic bibles. Warning, this activity could cause permanent damage to your wallet. If you are an ARRL member, there is a small coupon in the back of every book that gives you 10% off your next book purchase.

There is a new CD ROM coming out that is designed for hams to use in presentations to non-hams to give them a better understanding of amateur radio. OK, it is really a subversive recruiting tool. Individuals may order a copy of the *Amateur Radio Today* CD-ROM (approximately 70 MB) from the ARRL on-line catalog <https://www.arrl.org/catalog/?item=8861>. ARRL also has a new recruitment brochure for kids available in limited numbers (up to 25 copies) for free. To order copies of the brochure, interested clubs, or individuals should contact Linda Mullally, KB1HSV, lmullally@arrl.org or 860-594-0292.

38

A while ago, I mentioned the special group of rarely used frequencies that I always keep running in a dedicated scanner. I forgot to mention the "wilderness protocol" (emergency) frequencies of 52.525, 146.52, 223.50, 446.00 and 1294.50 MHz. These are the designated channels that a person can use if they need help, presumably in the backcountry or wilderness. Big city folks need not apply, as these frequencies are often used as "calling" channels in metro areas and might have above average chit-chat.

39

If you are a ham or a SWL, you can make up your own QSL cards. SWLers can use theirs to confirm they monitored the station at a given time. They can use their monitoring station's call letters or simply their name and address. Hams, of course, will use their FCC callsign. The usual format is a card 5-1/2 by 3-1/2 inches. You can design it on your computer using the inset table function in your word processor program. Use the landscape layout with a 2x2 table format. Set your margins to meet the correct size. You can use the Drawing menu with Word Art or similar tools to create special effects. You can inset a table within the table to get the nifty little boxes that included the Date, UTC, MHz, Mode, Station, etc. If you do not have a computer or do not feel confident in the needed skills, there are alternatives. Ask the grandkids, nephew, niece, or neighbor if they can assist. Local libraries offer free access and time on the computer.

Who's Listening – Vern of the Ozarks

Flippin, Arkansas, is just a little town in the north-central part of the state, about 75 miles southeast of Springfield, Missouri. While the town's name may be easy prey for witty remarks that will make a tourism official cringe, this location is actually well located for the scanning hobby. From Flippin, aircraft in Arkansas, Oklahoma, Kansas, Missouri, Illinois, Kentucky, Tennessee and Mississippi can be heard on a daily basis, plus various land mobile stations in Arkansas and Missouri.

Holding down the fort is Vern Modeland, a regular contributor to internet communication listservers and a knowledgeable resource for subjects as diverse as aviation, communications, broadcasting, journalism, public relations and photography.

"I use Diamond and Cushcraft discone antennas at 25 and 30-feet and a Ringo Ranger 6-meter amateur antenna at 30 feet for scanning. These antennas also share duty for 6 and 2 and 70 centimeter amateur radio. Scanning receivers are Bearcats. There's a BC9000XLT and BCT-7 (when it is not mobile) suspended under the shelf of the table and a BC890XLT atop it, as the photo shows," Vern related.

"This is a remote area, but an active one for aviation, both civil and military (refueling tracks and MOAs – military operations areas – in both Arkansas and Missouri). For ground-station scanning, I hear a group of several counties around me in both Arkansas and Missouri. This spot also is in a good location to receive several Arkansas state utility and public service repeaters located on higher mountains to the south and west about 40-50 miles."

Born in Iowa and later a resident of the Ozarks for many years, Vern has held a variety of media-related positions. Professionally, Vern served for ten years as a broadcast journalist for WHO AM-FM-TV in Des Moines, Iowa, where he received state government recognition for excellence in aviation reporting. He took that specialty to Wichita, Kansas, where he worked on public relations tasks for the Beech Aircraft Company and in the marketing department of Gates Learjet Corporation. After that stint, it was on to the Silver Dollar City theme park in Branson, Missouri, where Vern worked in promotions, advertising and marketing.

Switching gears again, Vern next operated a public relations firm specializing in health care marketing for physicians, dentists, health care organizations and hospitals in Springfield, Missouri. During his tenure, he created a health care

newsletter with a circulation of 12,000 and served as Assistant Director of Public Relations for Cox Medical Centers.

Government service was Vern's next calling, and he served as a contributing editor, writer and photographer for the Food and Drug Administration's Office of Public Affairs in Washington, D.C., with his work appearing in the *FDA Consumer* magazine.

After getting his fill of the District's hectic lifestyle, it was back to the Ozarks. Not quite retired, Vern has written a novel, several works of short fiction, and articles for *Backwoods Home Magazine*, *BackHome Magazine*, *The Ozarks Mountaineer*, and several national and international magazines and newspapers.

His accomplishments also include awards and honors for several investigative reports. However, the honor of most interest to *MT* readers was his placement as one of only five worldwide winners in an essay contest celebrating the Ontario DX Association's 25th anniversary in 1999.

That essay is a gem of a story, and you can read it in this month's *Letters* column. It illustrates the history of radio from a listener's perspective, highlighting how this invention influenced lives, began the global information conduit, and contributed to the evolution of technology we take for granted each day. Vern also managed to include a subtle political commentary based on the ethics and values he gleaned from the freedom of radio.

When not scanning and posting his findings on the Internet, Vern still finds time for freelance writing, consulting and traveling. He's also a real "road warrior" in his self-contained recreational vehicle rig. "We have a full-size conversion van and 24-foot trailer for recreation," Vern said in our e-mail interview. "Both are wired and outfitted to accept the scanners and HF radio equipment for mobile and off-site visits."

Vern, we wish you many miles of safe travel, good stories to write about, and great radio monitoring! And now, straight from Vern Modeland's scanner banks, here are some frequencies for scanning the central Arkansas-Missouri border counties:

Arkansas State Police

856.7625	856.8875	856.4125	856.8125
857.7625	857.8875	857.4125	857.8125
858.7625	858.8875	858.4125	858.8125
859.7625	859.8875	859.4125	859.8125

Missouri State Police

42.060
456.175

Marion County, AR, Sheriff

460.450
465.450

Baxter County, AR, Sheriff

156.210
855.9625

Izzard County, AR, Sheriff

154.740

Ozark County, MO, Sheriff

155.370
155.730

Hospitals/EMS/Air Ambulance

154.385
155.205
155.325
155.340

Fire/Rescue

154.370
154.570
154.965
155.020
155.115
155.340
155.485
158.745
435.050

911/OES

154.340
153.875

Aviation (Local activity)

122.700
122.800
123.000
123.600

Enroute Aviation (Memphis and Kansas City Centers)

132.375
132.4125
132.425
132.650
133.475
135.500
140.375

Military Aviation (Refueling tracks and MOAs)

138.100 138.250
138.400 142.525
233.800 235.100
238.900 239.800
257.600 257.850
260.200 263.050
269.500 269.650

272.200 273.450
277.400 281.450
283.700 284.000
285.500 285.600
291.900 294.900
298.400 258.200
279.500 306.900
311.000 319.700
321.000 323.250
324.600 327.600
335.500 335.800
338.300 343.800
344.600 348.700
348.900 349.100
351.400 353.800
354.000 364.200
372.200 375.200
380.200 381.300

Railroad

160.260
160.310
160.350
160.410
160.470
160.635

National Park Service (Buffalo River National Park)

164.250
164.745

Arkansas Fish & Game

151.385
154.175
155.600

Missouri Fish & Game

151.370

Arkansas Highway Commission

154.785

Missouri Highway Dept.

151.040

Regional Amateur Radio Repeaters

53.15 Harrison, AR
145.110 Fox, AR
145.270 Leslie, AR
145.150 Harrison, AR
147.000 Harrison, AR
147.075 Mountain Home, AR
147.120 Mountain View, AR
147.240 Flippin, AR
146.610 Jasper, AR
444.975 Harrison, AR

NOAA Weather

162.425 Mountain View, AR
162.500 Yellville, AR

◆ On-Scene Commander: From Justin to Kelly

Filming for the feature movie *From Justin to Kelly*, with "American Idol" stars Kelly Clarkson and Justin Guarini, utilized these business channels for production use in Miami Beach, Florida. Look for the movie in theaters this month:

173.3
173.425
173.45

◆ Scanning Detroit

Coming to us from Ira Paul, here are some Detroit area channels:

151.2050	Detroit Zoo Security
153.8300	Fireground (various agencies)
153.8600	Oak Park Police and Fire; Beverly Hills Police and Fire
153.9950	Birmingham Police
154.0400	Berkley Police and Fire; Huntington Woods Police
154.2350	Troy Fire
154.2650	Fireground
154.3100	Detroit Fire
154.3250	Fireground
154.3400	Royal Oak Fire
154.7400	Ferndale Police and Hazel Park Police
154.8450	Troy Police
155.0100	Royal Oak Police and Madison Heights Police
155.1150	Troy Police
155.1600	Detroit EMS
155.2800	AMR Ambulance
155.3400	Hospital Net
155.3700	ntercity, base
155.4300	Troy Police
155.5950	Troy Police
155.6550	Birmingham Police
155.8200	Ferndale Police and Hazel Park Police
155.8650	Intercity, mobiles
155.9400	Royal Oak Police and Madison Heights Police
158.2500	Berkley Police and Fire; Huntington Woods Police
158.7750	Oak Park Police and Fire; Beverly Hills Police and Fire
158.9550	Pleasant Ridge Police
160.4700	Grand Trunk Railroad Police
160.5300	AMTRAK
160.5900	AMTRAK
166.2500	Fox TV2 News
170.2450	Oak Park Police wireless mic for in-vehicle video system
423.6250	Southfield Fire dispatch
423.8250	Southfield Police ch. 2 car-to-car
423.9750	Southfield Police ch. 4
424.0250	Southfield Police ch. 3
424.3250	Southfield Police ch. 1 dispatch
425.3000	Southfield Fireground
450.2125	WWJ News
453.2500	Detroit Police Far West
453.3000	Detroit Police Near East & Wayne State Univ.
453.3500	Detroit Police Downtown & SW
453.5500	Detroit Police Special Events
453.7000	Detroit Police Far East
453.7500	Detroit Police Inner City West
453.8000	Detroit Police Palmer Park & NE
455.6125	WXYZ News
464.5750	Northland Mall security
464.9750	Northland Mall security

◆ Scanning Pennsylvania

Thanks to Matthew W. Lofland for providing his detailed list of Pennsylvania frequencies! Check these out when traveling through picturesque Southeast Pennsylvania:

Chester County's LTR System

855.4875	860.2375	866.5125
855.9875	860.4375	866.6125
856.2375	866.0125	866.7500
856.9875	866.0625	866.8625
858.9875	866.1250	867.0125
859.2625	866.2125	867.0750
859.9875	866.3875	867.1000

867.2125	868.2625	860.2625	MDT
867.3250	855.7375	860.4625	MDT
867.5125	858.2375	860.4875	MDT
868.0125	858.2625	860.9875	MDT
868.1125	859.2375	866.7250	MDT

Chester County Conventional Channels

33.1000	EMS
33.8600	Fireground
33.8800	Fireground
33.9200	Fireground
33.9600	Fireground
33.9800	Siren Activation
154.7400	Police east Dispatch
154.7850	Police Central Dispatch
155.4750	Police Intersystem
156.1500	Police Car-to-Car
156.2100	Police Car-to-Car
158.8500	Police Car-to-Car
158.9100	Police Car-to-Car
159.0300	Police Car-to-Car
159.6000	East and Central Fire and New Fireground
159.7350	West Fire and New Fireground
160.1850	New Fire Dispatch
460.5000	Police Car-to-Car
460.5500	Police Car-to-Car
857.9625	Police ch. 1 simplex
858.9625	Police ch. 2 simplex
859.9625	Police ch. 3 simplex
856.9625	Com ch. 1 simplex
857.4625	Com ch. 2 simplex
856.4625	Fire ch. 1 simplex
858.4625	Fire ch. 2 simplex
859.2625	Fire ch. 3 simplex
860.2625	Police and Fire simplex
859.4625	Police and Fire simplex
860.4625	Police and Fire simplex

Other Chester County Area Channels

151.4900	State Police Helicopter
154.7550	State Police Car-to-Car
155.4450	State Police Dispatch
155.4600	State Police Car-to-Car
155.5800	State Police @Avondale
155.6700	State Police @Avondale
155.7900	State Police @Avondale
155.9100	State Police @Avondale
159.2100	State Police Car-to-Car
33.0400	Med-A-Trans Ambulance
33.4200	Unid. Police and Fire channel
33.7000	Liberty Stem Fire Company
33.7800	West Grove Fire Company
33.9400	Elverson Fire Company
45.3200	West Chester Fire Company
46.3200	West Chester Fire Company
46.5600	West Chester Fire Company
152.9000	Martins Corner Fire Company
153.7250	Downtown Police
153.8000	Coatesville Police and Fire
153.8300	Coatesville Fire Company
153.9350	Downtown Police
154.0700	Martins Corner Fire Company
154.1600	Coatesville Fire Company
154.1750	West Bradford Fire Company
154.2200	Parkessburg Fire Company
154.2500	Thorndale Fire Company
154.2650	East Whiteland Fire Company
154.2950	East Whiteland Fire Company
154.3100	Downtown Fire Company
154.4000	Downtown Fire Company
155.0400	Coatesville Police
155.2050	SkyCare Helicopter
155.2200	Medvac-1 Helicopter
155.2350	SkyCare Helicopter
155.3250	SkyCare Helicopter
155.3550	Pennstar Helicopter
155.3850	Pennstar Helicopter
155.4000	Pennstar Helicopter
155.5650	Highland Township
155.8200	Caln Police
156.2400	West Caln Police and Fire; Martins Corner Fire Company
158.8050	Downtown Police

158.8950	East Brandywine
453.7625	Coatesville Police
460.6250	Cochranville Fire Company
462.0000	Avondale Fire Company
463.4250	West Grove Fire Company
500.3125	Lionville Fire Company
855.8125	Kimberton Fire Company

168.525	V.A. Hospital Police
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Lancaster County Area Channels

33.0200	East Lampeter Ambulance Association
33.0400	Ephrata Area Rescue Services
33.0800	Manheim Township Fire Company
33.4200	Hope Engine Company
33.4400	Akron Fire Department
33.4600	Liberty Fire Company
33.4800	Manheim Township Fire Company
33.5000	Unid. Police and Fire
33.5200	Littitz Fire Company
33.5600	Unid. Fireground
33.6000	Unid. Ambulance and Siren Activation
33.6200	Hope Engine Company
33.6400	Unid. Fireground
33.6800	Manheim Township
33.7200	Unid. Foreground
33.7600	Unid. Foreground
33.8000	Littitz Fire Company
33.8200	Lancaster City
33.9000	Unid. Fire Dispatch
33.9200	East Lampeter Township
45.0400	Mount Joy Forest Fire Channel
45.7000	East Earl Township Police
151.8350	Vigilant Fire Company (Columbia)
153.7700	Firemen's Association
154.7100	Lancaster County Police
154.8000	Lancaster Police
154.8450	Ephrata Police
154.8600	Lancaster County Police ch. D South
154.8750	Lancaster Police
154.9650	Manheim Township Police
155.1300	Columbia Police
155.3400	Hospital Net
155.4300	Lancaster County Police ch. A Metro
155.5200	Elizabethtown Police
155.5350	Lancaster County Police ch. E Northeast
155.5950	East Lampeter Township Police
155.6400	Lancaster County Police ch. C Northwest
155.6550	Manheim Township Police
155.6850	Lancaster County Police ch. B Countywide
155.8950	Lancaster County Police Car-to-Car
156.0300	Lancaster County Police
156.1500	Manheim Township Police
158.7300	Elizabethtown Police
158.7900	Elizabethtown Police
159.1500	East Earl Township Police
464.5750	Firemen's Association

Links of Interest for This Month's Column

Vern Modeland's website:

<http://www.runningriver.com>



The World's Largest Shopping Mall

Canada lays claim to the "world's largest" title in several categories. The world's tallest free-standing structure is Toronto's CN Tower and the world's largest waterfall (albeit shared with the United States) is Niagara Falls. The world's longest street – Yonge Street – stretches from downtown Toronto to the Minnesota border 1100 miles away (or so claims a Toronto newspaper).

I am sure that some readers may challenge one or more of these titles. There are taller waterfalls than Niagara and other countries are rushing to build artificial structures that may eventually rob the CN Tower of its crown. However, your humble Canadian columnist defers to none other than the galactically respected Guinness *Book of World Records* to support Canada's claim to the "world's largest shopping centre."

The West Edmonton Mall is bigger than the Mall of America in Minnesota (both were developed by the same Canadian company and national pride had to remain intact north of the 49th parallel). The West Edmonton Mall cost well over a billion Canadian dollars to build (it sounds more impressive in Canadian dollars at current exchange rates). The mall covers an area of 104 Canadian football fields (translated into American football fields that becomes 115 - no kidding).

The floor area of "WEM" is 5.3 million square feet and it covers the equivalent of 48 city blocks (I am pretty sure our square feet and city blocks are pretty much comparable to American square feet and city blocks – but go ahead, challenge me).

Promotional material for the mall refers to it as the "8th Wonder of the World." Personally I wonder why it was built in such a cold place. I have always rushed to the mall during my visits to Edmonton to get out of the cold (why do I always seem to have to go to Edmonton in winter?) I suspect the answer to the big question of "why there" can be found by asking where the developers lived – no surprises there.

The Guinness description of WEM as a "shopping centre" is like calling Washington, DC, a "government centre." Folks don't go to Baskin-Robbins for a vanilla ice cream just like they don't go to WEM to do their shopping. While at WEM it may be difficult to walk past the 800 stores without stopping to buy something, but that's not why people go. The world is full of shopping malls and WEM is no ordinary shopping mall.

There is a popular joke in Canada that the West Edmonton Mall owns more submarines than the Canadian Armed Forces (the Armed Forces

tried to play catch-up by buying some old British subs – but they sank). WEM's submarines are equipped with sonar and underwater cameras and are used to carry visitors around the enormous indoor lake called the "Deep Sea Adventure." A replica of the Spanish galleon *Santa Maria* has been built inside the mall at this attraction.

Superlatives abound even inside the mall. The World Waterpark is another "world's largest." This time Canada claims title to the world's largest indoor wave pool. The pool covers 5 acres and contains 2.7 million gallons of water (inside a "shopping centre" remember). It is surrounded by water slides and even a "beach," maintained at a balmy 30 degrees Celsius, where Edmontonians can come to pretend that it isn't really twenty below outside.

The "Ice Palace" is an NHL size hockey rink and claims the title of "second home to the Edmonton Oilers." The Oilers are the local NHL team and home to the "Great One" – Wayne Gretzky – before he left for Los Angeles. When the Oilers aren't practising there, the ice is used for figure skating displays or public skating.

Adjacent to the Deep Sea Adventure is the "Dolphin Lagoon" where trained dolphins perform for the children several times daily. Between performances the dolphins rest alongside the sharks, African blackfoot penguins, giant octopus and thousands of exotic fish in the caves below their pool.

The mall's designers left no reason to leave the mall during a stay in Edmonton. The Fantasyland Hotel is right inside the mall and provides very unusual and exciting accommodation. WEM's one hundred and ten restaurants allow visitors to stay for a month and never eat a meal in the same place.

But, it is worth leaving the mall and exploring the rest of the city. Edmonton is the capital of the Province of Alberta. The beautiful provincial legislature buildings lie just off the main streets through downtown, or if you are a sports fan, pay a visit to the Northlands Coliseum to catch a hockey game or visit the home of Edmonton's CFL (Canadian Football League) team, the Eskimos.

Edmonton Frequencies to monitor:

West Edmonton Mall 458.6625 460.6125 463.0875 463.5875
Fantasyland Hotel and Resort 452.8125

Province of Alberta

Alberta Environmental Protection 401.000
Water Management 415.4875 416.0625 416.0625 416.8375

Fish and Wildlife 416.0625 416.6625 416.7750 416.7750 416.8375
Public Works 411.0625
Community Development 451.6500
Capital Region Water Services Commission 413.9875 417.6375
Alberta Hospitals Psychiatric Treatment Centre 424.9875 425.2125 425.4625

City of Edmonton

General business 413.0125
Transit 413.0875 413.2625 413.3625 413.3875 413.4375 413.7375 413.8125 465.0125 469.0875 462.5375
Waste Management 440.2875 440.3125 440.3375 440.3500 440.3750 440.4000 440.4250 440.4500 440.4750 440.5000
St Albert Fire and Ambulance 424.0875 424.7875

Strathcona County

Emergency Services 417.7625 417.9375 418.4625 418.8625
Environmental Operations 418.1375 418.5875
Central Supply Services 418.1375 418.5875

Broadcasters

CBC 450.1375 450.8625 450.8625 455.1125 455.4125 455.6250 455.6250 455.6875
Corus Radio (CHED 630AM, CHQT 880AM, CISN 103.9FM, CKNG "Power 92") 450.3000 450.5625 450.6625 450.9625 455.3000 455.9375
"The Bear 100.3" 450.4875 455.0375
CJCA 450.9125
CTV Television 153.650 464.5000
A-Channel 183.730
CITV 460.1625
CFCW 455.8625

Edmonton Northlands 451.5875 452.4875 452.6375 454.2000 457.4875 457.6375 459.2000 460.2375 460.9875 461.6250 462.0625

Edmonton Oilers Hockey - Northlands Coliseum 458.3625



Canada's West Edmonton Mall

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Bearcat® 895XLT Trunk Tracker
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Frequency Coverage: 29.000-54.000 MHz., 108.000-174 MHz., 216.000-512.000 MHz., 806.000-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

The Bearcat 895XLT is superb for intercepting trunked analog communications transmissions with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer-control of your scanner via optional hardware and 30 trunking channel indicator annunciators to show you real-time trunking activity for an entire trunking system. Other features include Auto Store - Automatically stores all active frequencies within the specified bank(s). Auto Recording - Lets you record channel activity from the scanner onto a tape recorder. CTCSS Tone Board (Continuous Tone Control Squelch System) allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning pleasure, order the following optional accessories: **PS001** Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter \$14.95; **PS002** DC power cord - enables permanent operation from your vehicle fuse box \$14.95; **MB001** Mobile mounting bracket \$14.95; **EX711** External speaker with mounting bracket & 10 feet of cable with plug attached \$19.95. **CAT895** Computer serial cable \$29.95. The BC895XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS or LTR systems.



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Trunk Lockout • Trunk Delay • Cloning Capability
10 Priority Channels • Programmed Service Search
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Frequency Coverage:

29.000-54.000 MHz., 108-174 MHz., 406-512 MHz., 806-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

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Bearcat BCI25D APCO Project 25 digital software card.....	\$299.95
Bearcat 278CLT 100 ch. AM/FM/SAME WX alert scanner.....	\$139.95
Bearcat 250D 1,000 ch. TrunkTracker III handheld scanner.....	\$339.95
Bearcat 245XLT 300 ch. TrunkTracker II handheld scanner.....	\$189.95
Bearcat 248CLT 50 ch. base AM/FM/weather alert scanner.....	\$84.95
Bearcat Sportcast 200 alpha handheld sports scanner.....	\$159.95
Bearcat Sportcast 180B handheld sports scanner.....	\$139.95
Bearcat 80XLT 50 channel handheld scanner.....	\$99.95
Bearcat 60XLT 30 channel handheld scanner.....	\$74.95
Bearcat BCT77 information mobile scanner.....	\$139.95
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Sangean ATS18 45 memory shortwave receiver.....	\$139.95
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1,000 Channels • 20 banks • 50 Select Scan Channels
PASS channels: 50 per search bank + 50 for VFO search
Frequency step programmable in multiples of 50 Hz.
Size: 2^{1/2}" Wide x 1^{3/8}" Deep x 6^{1/8}" High

Frequency Coverage:

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(Full coverage receivers available for export and FCC approved users.)

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Monitoring Digital Selective Calling

Maritime Digital Selective Calling (DSC) has been in use for several years. It's kind of a cross between the older Selcal (Selective Calling) system used with ship radioteletype, and the newer digital paging systems so popular in the consumer market. Like some of the other "new" utility modes, it's basically for calling, and further communication will take place on another mode and frequency.

It's only in the past year or so that DSC has begun turning up with regularity in listener logs. International regulations provide DSC safety and alert frequencies of 2187.5 (watch keeping channel), 4207.5, 6312.0, 8414.5, 12577.0, and 16804.5 kilohertz (kHz). While higher frequency DSC allows routine traffic and calling, these medium frequency (MF) and high frequency (HF) channels do not have the capacity to allow any of this. They are considered primary alerting channels for the Global Maritime Distress and Safety System (GMDSS).

GMDSS is the comprehensive, global, day-to-daylight, communications system that replaced Morse telegraphy in the late 90s. While DSC is the usual entry into the system, it can also be used outside GMDSS. For example, a non-GMDSS pleasure craft might want DSC for safety when hailing large ships. Conversely, GMDSS can be used without DSC, such as when copying safety bulletins sent in SITOR (Simplex Telex Over Radio).

MF/HF DSC's major role in GMDSS is to automate the distress radio watch. Nowadays, "SOS" means a simple push of the right button—twice. This is, of course, the good and the bad news. When DSC first deployed, the huge number of false alarms almost doomed the whole system. In 1997-98, for example, only two out of 1200 alerts received in Australia were real. Part of the problem was inherent to HF, where the length and spottiness of normal signal propagation confused automated relay equipment at sea, filling the sky with bogus data. However, as the system

was fine-tuned, it began doing useful work.

◆ Technical Specs

DSC's modulation resembles that of the older SITOR: It's frequency-shift keying, either direct or by audio, 100-baud speed, 170-hertz shift. Audio-keyed, single-sideband, marine radios will have two tones, 85 hertz up and down, from a center of information offset 1700 hertz from the assigned carrier frequency.

DSC differs from teleprinting in structuring its messages into short, synchronous, data "packets," with various error checking measures. Each character uses ten binary bits, but since the last three are an error check, this leaves seven bits and 127 possible symbols. Symbols 00 through 99 represent decimal numeric values, while 100-127 are codes that can stand for a lot of different things depending upon which field they occupy in the transmission.

A full transmission consists of some framing information, plus several data fields. First of these is a format specifier. Then appears the address of the station being called. Next field is a traffic category, with possibilities of distress, urgency, safety, ship's business, and routine.

After this, the DSC radio self-identifies with a unique, 9-digit string called a Maritime Mobile Service Identity (MMSI). The MMSI's first three digits are peculiar to each country of issue. Merchant vessel MMSIs usually end in three zeroes. Recreational craft have one or two trailing zeroes, and coast stations have two leading zeroes. As MMSIs are assigned, they are recorded in MARS, the Maritime Mobile Access and Retrieval System maintained by the International Telecommunications Union (ITU).

Finally, comes the message itself, in one or more fields which can decode to different plaintext messages. The whole transmission often ends in RQ (Request Acknowledgement; symbol 117) or BQ (Acknowledgement RQ; symbol 122).

Program developers and lovers of arcane technical specifications will of course want to grab the standard, ITU-R M.493-6, which describes the various fields and messages in detail. The latest proposed draft eliminates the "ship's business" traffic grade and makes a few other changes.

◆ DSC Decoding

Stand-alone DSC control-

lers usually, though not always, complement GMDSS-compatible transceivers made by the same manufacturers. At least one company (Sailor Norge, AS) also makes a controller with a built-in scanning/watch keeping receiver.

For the rest of us, there are a few stand-alone, hobby-class decoders which include DSC. Most people, though, will be using a computer and software.

With computers, the "high end" packages such as Wavecom and Hoka will do DSC, GMDSS, and Navtex (Navigational Telex). The latter is not DSC, but it is part of GMDSS. It's a SITOR mode B service on MF, usually 518 kHz, for dissemination of safety information. It can be copied, minus some of its special protocols, by any SITOR decoder out there, and it is extremely interesting. That's another column, however.

Hobbyists will forever debate the merits of Wavecom versus Hoka, but everyone agrees that these two packages are very expensive. For those not wanting to part with such princely sums, there is an alternative. It's RadioRaft, a modestly-priced, shareware program for the IBM PC which includes an amazing range of capabilities for the money. It preferably runs from a straight DOS (Disk Operating System) boot, or a "piF" file which jumps to DOS. Therefore, not all versions of Windows can run it, as they do not all have a faithful implementation of DOS interrupt handlers. RadioRaft is not a full DSC, but the difference is mostly in its handling of the distress alarm and of no relevance here.

Unlike other PC programs, RadioRaft uses a hardware comm port, as opposed to the input on the sound card. A data-slicing interface is required between the receiver audio and the port. This sounds a lot scarier than it is. Those who would be interested in doing this probably have computers, and there are plenty of articles online about homebrew projects and low-cost commercial adapters.

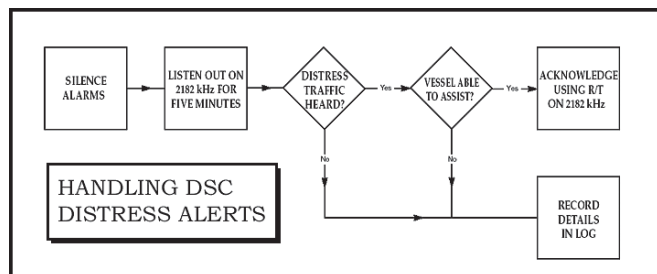
Good listening until next month.

Useful DSC Links

GMDSS Information
 (private site)
 Hoka Electronics
 ITU MMSI lookup

<http://www.gmdss.com.au/>
<http://www.hoka.com/>
<http://www.itu.int/ITU-R/terrestrial/mars/index.html>
<http://radioraft.free.fr/>
<http://www.wavecom.ch/>

RadioRaft
 Wavecom



ABBREVIATIONS USED IN THIS COLUMN

AFB	Air Force Base
ALE	Automatic Link Establishment
AM	Amplitude Modulation
ARQ	Automatic Repeat Request teleprinting system
ARQ-E3	French ARQ teleprinting system
Baud	Data throughput, in virtual bits/second
CAMSLANT	Communication Area Master Station, Atlantic
CW	Morse code telegraphy ("Continuous Wave")
DEA	Drug Enforcement Administration
DSC	Digital Selective Calling
E10	Israeli phonetic English female numbers
E10a	Israeli phonetic numbers, callup-only or abnormal
EAM	Emergency Action Message
FAX	Radiofacsimile
FEC	Forward Error Correction teleprinting system
FEMA	Federal Emergency Management Agency
HFDL	High-Frequency Data Link (air digital system)
HF-GCS	High-Frequency Global Communications System
HMAS	Her Majesty's Australian Ship
JSTARS	Joint Surveillance Target Attack Radar System
LDOC	Long-Distance Operational Control
M8	Cuban CW, "cut numbers" ANDUWRIGMT
M8a	Three-message case of above
M16	8BY, French intelligence CW numbers
M22	4XZ, Israeli Navy or intelligence CW numbers
M62	4-figure CW numbers; agency unknown
MARS	Military Affiliate Radio System
Meteo	Meteorological
MFA	Ministry of Foreign Affairs
M/V	Motor Vessel
NORAD	North American Aerospace Defense Command
Pactor	Packet Teleprinting Over Radio
PR	Puerto Rico
RSA	Republic of South Africa
RTTY	Radio Teletype
S10d	Czech language female, 3-digit numbers
SAM	Special Air Mission
SITOR-A	Simplex Teleprinting Over Radio, ARQ mode
SITOR-B	Simplex Teleprinting Over Radio, FEC mode
UK	United Kingdom
Unid	Unidentified
US	United States
V2	Cuban Spanish female, "Atencion!" callup
V2a	Three-equal-message case of above
VOLMET	"Flying Weather;" Aviation weather broadcasts

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time). "Numbers" stations (encrypted, usually unidentified, broadcasts thought to be intelligence-related) are identified in () with their ENIGMA station designators, as issued by the European Numbers Intelligence Gathering and Monitoring Association.

2187.5	LAOZ5-Vessel <i>Tor Gothia</i> , in a DSC safety test with OXZ, Lyngby Radio, Denmark, at 2020. (Day Watson-UK)
2474.0	PBC-Dutch Navy, Goeree Island, RTTY channel availability marker, at 2051. (Watson-UK)
2618.5	GYA-UK Royal Navy, Northwood, with weather FAX at 2102. (Watson-UK)
2670.0	Coast Guard Group Moriches-US Coast Guard, NY, with info and weather at 0014. (Ron Perron-MD)
2845.0	PBB-Dutch Navy Den Helder, RTTY channel availability marker at 2142. (Watson-UK)
2846.0	"Czech Lady"-3 figure "numbers" (S10d), callup to 555 and 338, at 1620. (Ary Boender-Netherlands)
3270.0	CIO 2Z92-Abnormal Israeli intelligence callup (E10a), simulcast on 4165 and 7605, at 2212. (Boender-Netherlands)
3485.0	Unknown-CW "numbers" callup to B3ET and RNJ5 (M62?), at 2257. (Boender-Netherlands) [Enigma shows M62 as "under investigation." -Hugh]
4027.0	Cuban AM "Atencion" numbers (V2a), callup at 0303. Unknown CW station repeating "378," at 0402. (Camillo Castillo-Panama)

4130.0	Unid-Live male voice reading "numbers" in a Slavic language, weak signal, every Wednesday at 1702. (Boender-Netherlands)
4479.0	Cuban AM "Atencion" numbers (V2), 5-figure groups in progress at 0310. (Castillo-Panama)
4718.0	Kinloss Rescue-UK Royal Air Force, working Rescue 13 at 0155. (Perron-MD)
5422.2	HEC-Bern Radio, Switzerland, with SITOR-B traffic list at 1800. (Watson-UK)
5598.0	Aeroflot 334-Russian commercial flight, reporting flight level 350 at 2212. (Patrice Privat-France)
5616.0	Reach 9169-US Air Force transport, giving position at 2201. Polar Air 605, selective calling check at 2234. (Privat-France)
5680.0	Kinloss Rescue-UK Royal Air Force, working Rescue 162, at 0052. (Perron-MD)
5696.0	Striker 24-Unknown aircraft calling GANTSEC (US Coast Guard Greater Antilles Section, PR), finally contacted by CAMSLANT, VA, who instructed them to landline, at 0211. (Perron-MD)
5705.0	CAMSLANT, working Coast Guard Rescue 6033, enroute to a distressed vessel, at 0330. (Allan Stern-FL)
5717.0	Milliner-US military, with a 137-character EAM simulcast on 8992, at 1432. (Jeff Haverlah-TX)
5717.0	Halifax Military-Canadian Forces, patch from Canforce Rescue 317 to Halifax Rescue Coordination Center, at 2112. (Perron-MD)
5761.0	Cuban CW "Cut number" station (M8), in progress at 1303. (Castillo-Panama)
6465.0	UIW-Kaliningrad Radio, Russia, with CW navigation warnings in Russian, at 2134. (Privat-France)
6679.0	FRA6XL-French Internet protocol router network, passing 300-baud "packet" data to a connected station, at 1336. (Boender-Netherlands)
6694.0	Halifax Military-Canadian Forces, patch to Greenwood Ops for Gonzo 6, at 0220. (Perron-MD)
6783.0	GYA-UK Royal Navy, London, with RTTY channel availability bulletin markers at 2141. (Watson-UK)
6854.0	Cuban AM "Atencion" numbers (V2), 5-figure groups in progress at 0305. (Castillo-Panama)
7508.0	ZSJ-South African Navy, Silvermine, sending FAX ice chart for West Weddell Sea, Antarctica, at 0800. (Bob Hall-RSA)
7635.0	CAP West 8-Civil Air Patrol, National Communicator's Net control station, taking check ins, then went to 14902, at 0032. (Perron-MD)
7771.7	Unid-Argentine Coast Guard, Buenos Aires, with SITOR-B ship movements at 0408. (Hall-RSA)
7889.0	Cuban CW "Cut number" station (M8a), five different days at 1300. (Castillo-Panama)
8040.0	GYA- UK Royal Navy, Northwood, with weather FAX at 2007. (Watson-UK)
8103.0	4XZ-Israli Navy, Haifa (M22), CW markers at 2035. (Watson-UK)
8122.0	Canberra Control-Australian Navy, working HMAS Wewak, at 1249. (Perron-MD)
8127.0	MIW 52-Abnormal Israeli intelligence callup (E10a), at 1611. (Boender-Netherlands)
8156.0	Unid-Possible Bahamas patrol net, passing orders to unknown vessel "2-C-2" at 0335. (Perron-MD)
8175.0	Czech Lady, 3-figure "numbers" (S10d), at 1620. (Boender-Netherlands)
8418.0	LSD836-Buenos Aires Radio, Argentina, with ARQ advisories and shipping movements, in Spanish, at 0520. (Hall-RSA)
8420.5	HEC-Bern Radio, Switzerland, with a list of commands in SITOR-A, then idling before resuming marker, at 1302. (Watson-UK)
8422.0	OSY-SailMail, Bruges, Belgium, working vessel WCZ 6989 in Pactor-II, at 0924. (Watson-UK)
8448.0	L2C-Argentine Coast Guard, Buenos Aires, marine weather in CW, at 0400. (Hall-RSA)
8906.0	Reach 005-US Air Force, working Gander air traffic control at 2242. (Privat-France)
8931.0	Watchdog 65-UK Fisheries surveillance aircraft, working Speedbird London (British Airways), at 1054. (Geoff Halligey-UK)
8971.0	Blue Star-US Navy, Roosevelt Roads, PR, working Branch 55 at 1643. Golden Hawk-US Navy, Brunswick, ME, clear and secure with Packer 21, at 1644. Fiddle-US Navy, Jacksonville, FL, working Cardfile 71K at 2004. (Perron-MD)

- 8983.0 CAMSLANT Chesapeake-US Coast Guard, VA, in a point-to-point search for shuttle *Columbia* debris with Rescue 1711, Rescue 1790, Coast Guard 6001, Coast Guard 2118, and Rescue 6015, all beginning around 1704. Coast Guard Air Station Clearwater, FL, working Rescue 6015, who reports some controlled fires from debris striking land, at 1917. (Perron-MD)
- 8992.0 Bush Pilot-US military, with a 22-character EAM simulcast on 11244, at 1911. (Haverlah-TX)
- 9016.0 God Parent-US military, with a 28-character EAM simulcast on 6697, 8992, and 11244, at 0336. (Haverlah-TX)
- 9023.0 Andrews-US Air Force, MD, working distinguished-visitor aircraft SAM 682, at 0233. Northern Lights-NORAD Northeast US air defense, NY, working Magic 75 at 2140. (Perron-MD)
- 9024.0 Cuban AM "Atencion" numbers (V2), in progress at 0214, "Final, final" at 0218, with audio having a loud 60-Hz hum which persisted until carrier dropped at 0235. (Hugh Stegman-CA)
- 9025.0 Unknown-US Air Force aircraft, ALE-initiated voice phone patch with no answer, but left it ringing for hours afterward, at 2113. (Stegman-CA)
- 9085.0 2805-Guardia Di Finanza, Italy, calling 2004 in ALE at 1018. (Watson-UK)
- 10204.0 Birds Eye-US military, with a 28-character EAM simulcast on 8992 and 11244, at 1748. (Haverlah-TX)
- 10248.0 8BY-French Intelligence, Paris (M16), with a CW "numbers" marker at 1240. (Watson-UK)
- 10780.0 USS *McInerney*-US Navy vessel, downrange on the *Columbia* launch, working Cape Radio at 1536. (Perron-MD)
- 10917.7 RFTJ-French Forces, Dakar, Senegal, ARQ-E3 circuit test at 0622. (Hall-RSA)
- 11175.0 Razor 93-Back end of US Air Force/ Air National Guard 116th Air Control Wing E-8C, patch via Salinas HF-GCS to Raymond 19 (Robins AFB, GA), at 1743. (Stern-FL) [*The 116th at Robins is the Air Force's first "blended wing," replacing the decommissioned 93rd ACW in this JSTARS mission.* -Hugh]
- 11175.0 Razz 408-US military, phone patch via Andrews HF-GCS at 1758. (Haverlah-TX)
- 11181.0 Backyard-US military, with two 28-character EAMs, simulcast on 8992 and 11244, at 1953 and 2012. (Haverlah-TX)
- 11205.0 Smasher-US Air Force, Key West, FL, working Dagger 88 at 0234. (Perron-MD)
- 11207.0 "V-1-V"-Unknown military, calling Sealord (US Navy FACSAC, Jacksonville), no joy at 1922. (Perron-MD)
- 11232.0 Trenton Military-Canadian Forces, patching Canforce 85 to Trenton Wing Ops, at 2017. (Perron-MD)
- 11243.0 "Aircraft"-Possible US military or military reserves, several calls to Skybird [*Old group callword: any ground station this net - Hugh*], no joy, since this is the old frequency, at 1914. (Haverlah-TX)
- 11244.0 Razz 408-US military, possibly an E-6B, making an unsuccessful call to Mainsail (any station this net), at 1755. Pup 35-US military, orderwire traffic with Dewberry, clear and secure, at 2108. Prologue-US military, orderwire with Kiwi Bird, at 2150. (Haverlah-TX)
- 11345.0 Cyprus 1386-Commercial flight, sent to 13890 kHz by Stockholm for a phone patch, at 1347. (Privat-France)
- 11418.0 FJY5-French DTRE [*Direction des Telecommunications des Reseaux Exterieurs, telecom agency for French foreign research bases, etc.* -Hugh], Crozet Islands [*Halfway between Madagascar and Antarctica, very desolate, and with far more penguins than people* -Hugh], passing ARQ-E3 personal messages in French, at 0420. (Hall-RSA)
- 12133.0 STA-Possible Tunisian military, calling STA20 in ALE, at 1701. (Watson-UK)
- 12577.0 H9VO-M/V *African Warrior*, giving position in DSC, at 1600. (Privat-France)
- 12587.0 LZW-Varna Radio, Bulgaria, with a SITOP-B bulletin in Bulgarian, at 1000. (Watson-UK)
- 12932.2 Unid-Probably Spanish Navy, offline encrypted RTTY at 1705. (Hall-RSA)
- 13043.0 XDD-Standard time station, Chapultepec, Mexico, CW pips and identifier, beginning at 1925. (Neal-TX)
- 13131.0 UGE-Arkhangelsk Radio, Russia, phone patch for a vessel at 1309. (Boender-Netherlands)
- 13155.0 Java Jive-US military, with a 28-character EAM simulcast on 11244, at 2236. (Haverlah-TX)
- 13270.0 Gander VOLMET, Canada, with aviation weather at 2151 through 2200. (Gary Neal-TX)
- 13274.3 Unid-Shipping company traffic about loading cargo, in Pactor at 1455. (Hall-RSA)
- 13282.0 Honolulu VOLMET, HI, with aviation weather at 0137 and 0155. (Neal-TX)
- 13333.0 Unid-Ground station working airliner in Spanish, possibly Cubana Airlines LDOC, at 0004. (Perron-MD)
- 13339.0 Operations-Aero Mexico LDOC, giving arrival weather for Brasilia at 1419. (Perron-MD)
- 13342.0 Stockholm Radio-Ground station patching flight 67A to company Dispatch, in French at 1402. Stockholm, patching Gemini 5028 to Dispatch at 1424. (Perron-MD)
- 13444.0 RFQP-French Forces, Djibouti, ARQ-E3 circuit test at 0616. (Hall-RSA)
- 13927.0 Gofer 03-US Air National Guard C-130, with a MARS phone patch, at 1850. (Stern-FL) AFA1EN-US Air Force MARS, patch for Wise 81 (a C-130E) at 1920. (Perron-MD)
- 14403.0 BMLV1-Austrian Ministry of Defense, Vienna, calling 11111 in ALE, at 1147. (Privat-France)
- 15025.0 Smasher-US Air Force, Key West, FL, working Evergreen 352, an Air Mobility Command contract transport, at 2123. (Perron-MD)
- 15094.0 Folk Song-US military, with a 28-character EAM simulcast on 8992 and 11244, at 1828. (Haverlah-TX)
- 16267.0 OLZ88-Czech MFA, Prague, with ALE-initiated data to OLZ55, at 1140. (Watson-UK)
- 17430.0 9VF209-Kyodo News, Singapore, with a clear Japanese newspaper FAX, 60 lines per minute, at 1606. (Hall-RSA)
- 17441.6 5YE-Nairobi Meteo, Kenya, coded weather in RTTY at 1236. (Watson-UK)
- 17916.0 Stockholm Radio-Ground station patching Evergreen 485 to Evergreen Dispatch, at 1615. (Perron-MD)
- 17940.0 Control-Iberia Airlines, possibly an LDOC, working a flight in Spanish at 2150. (Perron-MD)
- 17946.0 New York-New York Radio, working KLM 626 at 1445. (Perron-MD)
- 18320.0 BRA-Slovak MFA, Bratislava, sounding in ALE at 1241. (Watson-UK)
- 18320.8 RFTJ-French Forces Dakar, Senegal, ARQ-E3 circuit test at 1510. (Watson-UK)
- 18571.5 RAH-Possible Tunisian MFA, FEC markers at 1525. (Hall-RSA)
- 19131.0 Coast Guard 1790-US Coast Guard HC-130, in patch via Atlas (US Drug Enforcement Administration comm facility, IA), to Clearwater Ops, at 1755. (Perron-MD)
- 19320.0 OLZ88-Czech MFA, Prague, with ALE-initiated digital FAX to OLZ78, at 1135. (Watson-UK)
- 19340.0 BMLV1-Austrian Ministry of Defense, Vienna, calling 11111 in ALE, at 1144. (Watson-UK)
- 19463.0 Unid-Sudan News Agency, Khartoum, RTTY news broadcasts in English at 1000 and 1610, and in French at 1509. (Watson-UK)
- 19945.0 NKT-Algerian Embassy, Nouakchott, Mauritania, with ALE-initiated FAX to Algiers, at 1518. (Watson-UK)
- 20617.0 BRA-Slovak MFA, Bratislava, sounding in ALE at 1042. (Watson-UK)
- 20631.0 MPA-US Air Force, Falkland Islands, sounding in ALE at 1111. (Watson-UK)
- 21810.0 BRA-Slovak MFA, Bratislava, sounding in ALE at 1057. (Watson-UK)
- 21866.0 Army Ruler-Voice exercise callsign for US federal or military station also using ALE address FC6FEM (FEMA Region 6, TX), and working Athletic Coach (FC0FEM), Artillery Cove, Armor Suit, and Axelrod, also using 10493, at 1800. (Haverlah-TX) [*This is the "A" callsign exercise held the 3rd week of the month.* -Hugh]
- 21867.0 KUW-UK military/diplomatic, Kuwait, ALE sounding at 1108. (Watson-UK)
- 23337.0 IKF-US Air Force Keflavik, Iceland, ALE sounding at 1021. (Watson-UK)
- 23822.0 CYP-UK military/diplomatic, Cyprus, ALE sounding at 1200. (Watson-UK)
- 24100.0 OLZ88-Czech MFA, Prague, calling OLZ67 in ALE, at 1135. (Watson-UK)
- 24268.0 KUW-UK military/diplomatic, Kuwait, ALE sounding at 1324. (Watson-UK)
- 25186.0 KUW-UK military/diplomatic, Kuwait, ALE sounding at 0955. (Watson-UK)

Two Diplomatic Nets

This month we take a look at two rare diplomatic catches these days – MFA Copenhagen and Budapest. There is also news of a new Venezuelan Navy ALE network.

❖ MFA Copenhagen

The Danish diplomatic service has scaled down its HF presence considerably in the past few years, but its distinctive, although not unique, 400Hz spaced TWINPLEX signals can still be heard from time to time. The frequencies used by the organization have remained largely unchanged for a decade and have a distinctive 0.9kHz offset, a feature shared by the Norwegian diplomatic service's TWINPLEX modems. Here are the frequencies collected over the last few years:

Logged Frequencies:

7467.9 7468.9 11327.9 11341.9 11419.9 11437.9 13211.9 13274.0
13457.9 13486.9 16209.9 16284.9 16406.9 18513.9 18576.9 18583.9
19108.9 19230.9

Reported Frequencies:

7313.9 7468.9 9274.9 9327.9 13457.9 13486.9 13490.0 16128.9
16309.9 18513.9 18586.9 18588.5 18594.0 18756.9 19019.0 19025.0
19107.0 19622.0 23180.9

Web Address:

<http://www.um.dk/english/>

Most plain-text traffic is in Danish, although English press summaries or news bulletins can sometimes be seen also. An on-line (continuous stream) encryption scheme, similar to that used by the Swedish and Norwegian Diplomatic services, leads in with:

```
.....  
ssswwwwssswwww  
y  
[crypto text]
```

Unlike many other cryptographic messaging formats, this type of traffic ends abruptly and there is no "nnnn" or "zzzz" to denote "end of message." However, the marker "endumtxt" or "end of text" is sometimes seen instead. Along with similarity in language, system and offset, the "ssswwwwssswwww" encryption lead-in, in particular, means that Copenhagen is often mistaken for MFA Oslo. An off-line (regular blocks of text) cryptographic scheme is sometimes used, too, where the lead-in is structured as:

```
kkck sssww wsssw wwsss wwweo  
enfng vqqvq qvqeo eshsv qvulu eoerk  
reoem ymeoe shszn ibcdc
```

There is very little addressee information in the messages sent and embassies are called up strictly by the TWINPLEX selcal mechanism (which can be read by any standard SITOR decoder). All selcals are in the TPOxx series. Opera-

tor chatter, which often follows messages, is often the only clue to the recipient.

Call	Selcal	Location
OZU25	TPRX TPRP	MFA Copenhagen Accra, Ghana
OZU37	TPEX	Ankara, Turkey Baghdad, Iraq Beijing, China
OZU35 OZU31	TPRM TPIS	Beirut, Lebanon Bucharest, Romania Budapest, Hungary
OZU30 OZU32	TPEC TPIC	Cairo, Egypt Dar es Salaam, Tanzania Harare, Zimbabwe
OZU34 OZU38	TPEF TPOC TPIP	Jeddah, Saudi Arabia Lagos, Nigeria Maputo, Mozambique Moscow, Russia
OZU39 OZU36	TPEY TPOK TPOQ	Nairobi, Kenya New Delhi, India Prague, Czech Republic?
OZU33	TPOP	Rome, Italy Teheran, Iran Tel Aviv, Israel Warsaw, Poland?

❖ MFA Budapest

Like many other diplomatic operations, the Hungarians appear also to have scaled back on the use of HF. However, their distinctive 125bd/170Hz FEC system, DUP-ARQ or ARTRAC, remains in use today.

The ARTRAC system is adaptive: in other words, it will automatically change channels if it detects interference or a poor link-quality. However, whereas most adaptive systems tend to jump to a new frequency some considerable distance from the original channel, ARTRAC instead operates over a 2kHz-wide band. Five "slots" occupy the 2kHz and are offset from the carrier point by +0.4, +0.8, +1.2, +1.6 and +2.0 kHz.

The behavior often means that sending and receiving station sound as though they are on the same frequency but actually can be separated by as little as 400Hz or as far as 2kHz from each other. One also notices that when first tuning to a frequency, and sometimes during transmission, the stations sequentially test each channel.

Here are some frequencies on which MFA Budapest has been heard:

3860.0 4553.0 5477.4 5648.4 6780.4 9114.0 9300.7 10400.0 12260.4
12260.8 12262.4 12262.8 13379.0 13380.0 13459.0 13676.0 13462.0
13575.0 13875.3 13875.4 13876.6 14810.0 14840.4 14840.8 14841.2
14873.0 15675.0 15677.0 16061.7 16453.4 16454.2 16454.6 18040.4
18040.8 18399.3 19810.0 20036.6 20045.0 23262.0

There is a distinctive ending of messages with "www." Off-line encryption is blocked in 100 groups.

Unlike most other diplomatic operations, stations sign off using their assigned ITU HGXxx series callsigns, where the MFA is HGX21, as

this example message shows:

```
hgx21 de hgx55  
kkkk  
nnn  
270/alg/473  
31  
algir, 1996.08.25
```

zatout sid ahmed algeriai aap., bolti segeed
(szuel.: tiaret, 1974.04.26., utlevsz.: yuiiwrn
kiaall.: tiaret, qootmqwmpmn eerv.:
wppmqwmpomn magaan) beutazo vizumot
keer egysszeri belepeessel turista ceelbol 15
napra. km-1)

repjegy alg-prg-alg utvonlra, devizafedzeeti
igazolaasa 11.000,- frf-rol rendben.
szaallodafoglalaassal rendelkezik a hotel
astoriaaban 96.08.29 a pompim koezoetti
idoeszakra.

www

❖ Venezuelan Navy River Units

While trawling the 20MHz frequencies one late Sunday, we recently stumbled across a number of interesting ALE identifiers on 20396.8kHz (USB). They were as follows:

```
COFFRI1  
COFFMU2  
PNEN1  
PNFA1  
PNME1  
PNPP1
```

A quick web search identified COFFRI as being the acronym for one of the Venezuelan Navy's river patrol (Comando Fluvial) bases, in this case Comando Fluvial Fronterizo GB Franz R'squez Iribarren.

From that discovery, it was apparent that the COFFMU was the other command center named for TN Jacinto Mu-oz, with the PN-series identifiers being river navy posts (Puestos Navales). These are located in various parts of the rivers Arauca, Barinas, Meta and Orinoco.

So far, the missing PN identifiers (there are at least 14 in total) and the other command center "Comando Fluvial Eje Orinoco-Apure" (COFFOA3 perhaps?) have not been seen.

That's all for this month. Enjoy your listening.

Resources

Danish Diplomatic Service:

<http://www.chace-ortiz.org/umc/mfotext/Denmark.txt>

Hungarian Diplomatic Service:

<http://www.chace-ortiz.org/umc/mfotext/Hungary.txt>

Venezuelan Navy:

<http://www.fav-club.com/niveldivision.htm>

World Radiocommunications Conference 2003

Organized by the International Telecommunications Union, WRC-03 will take place in Geneva in June. Important issues concerning the broadcast service will be addressed. For an excellent professional overview of the formal Agenda, please visit http://www.hfcc.org/pro/HFCC_WRC.doc

High Frequency Coordination Conference (HFCC)

Process Management and Control Documentation.

Flow charts and other documentation used at the previous meeting at Bangkok for the B02 transmission season may be viewed at <http://www.hfcc.org/bangkok/b02procs.pdf>. This shows how the HFCC meeting functions, and the way in which frequency requirements are submitted and analyzed for incompatibilities, using propagation prediction software. That site also gives a full listing of many identified frequency "collisions" which were examined at the meeting.

The new international season starts on March 30. This is the "long one" of seven months, and it will be interesting to see how the actual frequency allocations hold up, with the sunspot number predicted to fall

to about 40 by October. This will virtually mark the conclusion of Solar Cycle 23. Recently, there have been very large excursions in the daily sunspot count, ranging from 150 in mid-January, to 75 on Feb 1, and up again to 180 on Feb 11!

I would suggest that broadcasters would be very unwise to attempt to use 17, 18, and 21 MHz for long-haul transmissions across substantially darkness circuits during the A03 season, but operations in those bands would be reliable for shorter routes over totally daylight, or partially daylight paths.

The High Frequency Coordination Conference has completed its work for the development of the A03 Master Schedule. Delegates met for a week in Sandton, South Africa, and the public (modified) schedule (about 100 A4 pages!) is expected to be available during the first week of April at <http://www.hfcc.org>. You may see a selection of photos taken at the South African meeting at that Website (Bob Padula, EDXP)

Eike Bierwirth's Online SW Schedule should also be checked at <http://www.eibi.de.vu/> updated for the A-03 season as soon as possible

ANGOLA The Angolan government has accused Rádio Ecclésia, the independent Catholic station, of making 'terrorist broadcasts'. The minister responsible for social communication, Hendrik Vaal Neto, interviewed on the government's RNA, said the content of a program on RE was 'unacceptable', a vehicle of offense, defamation and false and destructive propaganda against public figures and institutions, but did not give any examples. Some of the most popular programs are call-ins from listeners, where the most diverse opinions are aired, for and against the government (AFP and Jornal Público via Fernando de Sousa Ribeiro, Porto, Portugal, *radioescutas*)

AUSTRALIA The start of HCJB's service to Asia was delayed week after week in January, due to structural damage to the antenna system by a willy willy (strong but very small tornado) (CQ SW News). Another problem was an arc in the antenna burning up an insulator; climbed tower to repair. One of the arms from the tower holding up the antenna collapsed. No one hurt. Busy reconstructing that now, causing another delay until Feb 2. Structural damage to antenna wires too (Doug Weber, HCJB frequency manager, DX Partyline). Tests finally began Jan 27 (Ian Williams, HCJB Australia via Alokesh Gupta, India). Regular from Feb 2 at 1230-1730 UT. Well heard but after 1410 weak due to poor propagation (Alokesh Gupta, New Delhi, *DX Listening Digest*)

BRAZIL Rádio Gazeta, São Paulo, 5955, 9685 and 15325, has Jornal da Gazeta AM Universitária programming, M-F 0900-1000, 1500-1600, 0100-0200; At other times religion from Rádio Canção Nova (Célio Romais, *@tividade DX*). So non-religious programming has longer hours than thought last month (gh)

Rádio Anhangüera, Goiânia, GO, heard at 1458 on 9830, 2 x 4915 with lots of regional ads, sertaneja music. Not \ 11830 which carries the CBN network, while 4915 has local programming (Samuel Cássio Martins, DXCB, Brasil, *Conexión Digital*)

CHINA China Radio and TV has ordered an ALLISS rotatable antenna, and thirteen 500 kW SW transmitters from Thales, bringing the total number of such Thales transmitters installed in China up to 19. All equipment is scheduled to be delivered and taken into operation in 2003 (Thales, Paris, press release). Whooppee! More crash and bang jammers! Thanks, France!! (gh)

Accusing China of jamming all its VOA and R. Free Asia shortwave broadcasts into the PRC, especially Tibet, the Broadcast Board of Governors in Washington went before Congress in December to press for a concerted effort by the U.S. to end the problem and to obtain equal treatment for US broadcasters operating in China on the same basis as China's networks widely enjoyed in the US (e-broadcast Asia via Richard Jary, *Cumbre DX*). The Ying Lian mystery is finally clarified (George J. Poppin, Audibility Monitor, San Francisco, *DX Listening Digest*). Viz.: My name is Shang Chunyan and I'm in charge of letters from Americas. But our collective name is Ying Lian, to make our work more convenient (Ying Lian, English Service, *crieng@cri.com.cn* via Poppin)

COLOMBIA From time to time I see references in MT to Voz de la Resistencia not being heard. I can assure you that they are on the air most days and are amazingly punctual. Their broadcast is at 1300 GMT every day. Normally, they play warm-up music about

10 min prior – say 1250 onwards. Their broadcasts carry a sort of editorial and then "war" bulletins and opinion pieces, on 6239.80 AM but setting the radio to USB helps beat some of the interference. The nominal, announced frequency is 6.240 MHz. Usually jammed, except on Sundays when mostly "cultural programming." Fellow hams I have asked have all heard the broadcasts. Seldom are signals very strong (Tony Conte, HP1KL, Panamá) 1300 being too late for propagation much further.

R. Melodia AM, "La radio líder", heard testing on SW 6140 at 2300 Jan 29, announcing MW 730 HJCQ as 100 kW and SW (Adán González, Catia La Mar, Venezuela, *DX Listening Digest*) On 6140.53 at 2245-2400, "HJQE, 6140 kilociclos, onda corta ..." (Michael Schnitzer, Germany, *hard-core-dx*) 6140.57, ID at 0940 Feb 1, ballads (Don Nelson, Oregon, *Cumbre DX*) Heard in Caracas all day, better in the daytime when there is no interference; signal strengthens after 2200 but so does QRM (José M. Valdés R., *Conexión Digital*) Lasted less than a week (Adán González, VENEZUELA, *DX Listening Digest*)

COSTA RICA 5845.05, Radio Nacional de España, from unknown QTH, weak at 1115 (Björn Malm, Quito, Ecuador, translated by SWB-editor Thomas Nilsson) It's 11815 minus 5970, Cariari de Pococi (Roberto Scaglione, Sicily, *DX Listening Digest*)

CUBA 27500, Radio Habana Cuba, 2002-2016 in Portuguese, 2 x 13750 harmonic weak/messy with fair peaks (Harold Frodge, MI, MARE) 27140-27690 could be fruitful for 2nd harmonics from 13 MHz broadcasters, if one can overcome all the CB/freebander infestation (gh)

EUROPE A group of volunteer broadcasters plans to re-create the Voice of Peace, the famous offshore station of the 1970s owned by Nobel Peace Prize winner Abe Nathan. Plans are for the new station to broadcast on SW from somewhere in Europe. Dutchman Jan van Jager, one of the four people behind the project, told *Media Network* that the station will not broadcast propaganda, just peace messages and music. Format will be top 40 and easy listening music, inter-mixed with peace and loving awareness jingles. The organizers are hoping to raise sufficient money to hire airtime on a European SW station. See <http://vop.uk.tripod.com> (© Radio Netherlands Media Network)

GERMANY Margot Forbes of DW English Service sent a form response to many listeners concerned about the deletion of SW to North America, as reported last month. The final broadcast should be Saturday, March 29. She says, "As you are probably aware, our budget has been slashed time and time again by the German Government, leaving us with the problem of what we can cut down on. Shortwave frequencies are particularly expensive and the decision has been made to cancel some frequencies."

Why this all-or-nothing shortwave approach? Let's face it, three half-sesquihours in English to North America, mostly duplicated, on 5 or 6 frequencies each from as many relay sites, is overkill. We could make do with two, or even one broadcast, on perhaps two or three frequencies, like so many other SW stations. Look how well R. Netherlands has done for decades with only two frequencies per broadcast via Bonaire! They cut could back to that level, retain their audience and save a bunch of Euri (gh)

GREENLAND Chief engineer at KNR and the Tele

*All times UTC; All frequencies kHz; * before hr = sign on, * after hr = sign off; // = parallel programming; + = continuing but not monitored; 2 x freq = 2nd harmonic; A-03=summer season; [non] = Broadcast to or for the listed country, but not necessarily originating there; u.o.s. = unless otherwise stated*

administration confirmed previous report. KNR pays for transmissions on 3815 USB with 100 Watts from Tasilaq (Angmagssalik) on the East coast – probably from their coast station, which also operates on several SW frequencies. Per translation of <http://www.knr.gl> “We broadcast on 3815 kHz USB 100 watts at 1205-1305 and 1825-1925 local time (for UT add 3 hours [summer 2 hours]). The purpose of the transmissions is not broadcast, but only to supply the fishing fleet on ‘Dohrns Bar’ and the ‘Irminger Sea’ (both located between Tasilaq and Iceland).” (Erik Kaie, København, *DX Listening Digest*) Not even a carrier was audible here at 2125-2225 UT (Anker Petersen, Denmark, DSWCI DX Window)

HUNGARY Radio Budapest plans an additional morning transmission to SE Australia from Mar 30, 2100-2130 on 11920 (Bob Padula, EDXP World Broadcast Monitor)

INDIA [and non] In a decision that is expected to cater to the Indian Diaspora overseas, All India Radio is to have slots for Indian programs on the domestic channels of the VOA and BBC. Both had approached AIR for slots on its channels, and Prasar Bharati had in turn asked for similar slots on their domestic channels in the United Kingdom and United States (*The Hindu*, via Kim Elliott) “Domestic channels of VOA”? They are in for a rude awakening – As if to clarify, here’s a revised version the next day (gh)

In the case of VOA – which does not have a domestic channel – the Prasar Bharati has retained the option of charging the broadcaster a slot fee if the AIR does not want to air programs on its overseas radio stations (*The Hindu* via Jilly Dybka, DXLD)

INTERNATIONAL VACUUM WRN has a new website, and the *World Of Radio* page is now: <http://new.wrn.org/listeners/stations/station.php?StationID=24> To find the audio go to the Archive section and click on the little T or other symbol under the right or wrong day of the week (gh)

IRAN [non] I am hearing a Middle Eastern language at 1630-1700 on 9375 since. I think this is the promised Voice of South Azerbaijan (Hans Dieter Schultz, Germany, *DX Listening Digest*) Many mentions of Azerbaijan, cut off mid sentence at 1700. Fair strength and steady signal, tinny modulation and some transmitter hum but easily readable (Mike Barraclough, UK, DXLD) SANAM site <http://www.cehreganli.com> mentions it being on 9375 (P. Boselli, DXLD) Showed faulty 9573 instead! 1650 solid signal, 9375.00 and fine modulation (Wolfgang Bueschel, Germany, BC-DX) Very good in Azeri on at 1630-1700 Wed/Thu on 9375 instead of announced 9570 (Ivo and Angell Observer, Bulgaria) The very minimum in competence for any SW station or program is the ability to announce its own frequencies correctly (gh)

IRAQ [non] Voice of Iraqi People/Voice of the Iraqi Republic is supported by the CIA with facilities of Saudi Arabia. We can show that clearly in its news. It presents the freshest news concerning the US actions in Iraq, before any other Iraqi clandestine. Has a wide number of correspondents in Iraq. News reports are of great level of precision, the smallest details – the mood of the people, economic situation, military movements, and even the simplest events in Saddam’s family. So I think that some of these are intelligence reports. Has a program mocking Saddam Hussein and his family, describing them as killers, thieves; also, “Lies of the dictator” analyzing the speeches of Saddam part by part, and comparing to reality. In Arabic, Turkmen and Kurdish at 1300-0300 UT on 9563, 9570 and 11710 kHz. ID: “*Ida’at al-jumhuriyah al-iraqiah min Baghdad, Sawt al-sha’ab al iraqi*”. Quality here in Tunisia is poor, audible only after 1800 UT. Later found on 9750 ex-9570 at 2305 with message to Iraqi soldiers to refuse Saddam’s orders. New frequency is much quieter (Achrif Chaabane, Tunisia, CRW)

ISRAEL [non] On 21745 at 0700-0727 in Hebrew is a transmission of Islamic Republic of Iran Broadcasting. It does not identify as Iran. It calls itself, Kol Dah-veed, the voice of David, on 31 and 41 meters. They do not give frequencies, but time as 0700-0730 UTC. I hear them with SIO 555. They gave fax numbers which are in Teheran, 0098(21)204-7076 and 0098(21)204-6397 and addresses: Iran, Teheran, PO Box 19395-6767; Syria, Damascus, PO Box 9731; Lebanon, Beirut, PO Box 113-718; Bahrain, Manama, PO Box 26273

All of the above have no postal ties with Israel. They gave a web-site where you can hear the program: <http://www.iribworld.com> This is different than that given in PWBR and WRTM for IRIB. They announce as if it was yesterday evening. There you have an opportunity to get a QSL of a clandestine; no mention of reception reports in the programs (David Crystal, Israel, CIDX Messenger)

ITALY Rai heard on 4875, at 0529: it’s 11985 (in Somali) minus 7110 (in Romanian) from Roma Prato Smeraldo (Roberto Scaglione, Sicily, *DX Listening Digest*) If you hear Rai on a weird frequency, compute likewise; see also COSTA RICA

JAPAN 3607.5 USB, NHK feeder, at 1025 very weak, but audible commentary and music \ 9750 and 11815 (David Hodgson, TN, *DX Listening Digest*)

KASHMIR [non] Since late January, I hear a new station, Radio Sadaye Kashmir on 9890 at 0230-0330, first in Urdu, and at 0310-0330 in another language. Carrier and test tone start about 0210 and it is very strong in Hyderabad, S. India. ID given only once at sign on and no address. Consists of songs and easy going talks (Jose Jacob, dx_india)

Not tones, but hets from 9891 and 9889 until program start at 0230; Means V. of Kashmir, mentions Pakistan (Hans Johnson, TX, Cumbredx) A Pakistani transmitter on 5080 at times also does that; several other ones can be ruled out (Noel R. Green, England, Cumbredx) Programs are not anti-India. Only Urdu songs and easy discussions. Every day at 0300 there is a commentary mostly about the Pakistani affairs. Mentioned that in India there is a democratic government (Swopan Chakroborty, Kolkata, India, *DX Listening Digest*) At 0220 found the test tone on 9890, S-9, very good audio from 0230. Will be interesting to find out where this comes from (Steve Lare, MI, DXLD)

KOREA NORTH [non] Radio Free Asia says it will double its broadcasting to North Korea to four hours a day because of the tension between Pyongyang and Washington (Reuters via Forbes via Artie Bigley) 1400-1500 5855 7475 12000T 13625T

1500-1700 11870S 13625T

2200-2300 7460 9455T 11775S 11905T

(via Wolfgang Bueschel, DXLD; Observer, Bulgaria) S=Saipan, T=Timin; other sites secret

KYRGYZSTAN 4050, unID via Krasnaya Rechka, Bishkek, *0225-0340, with test tones, non-stop pop songs from Europe and Central Asia. Same propagation characteristics as Bishkek on 4010. Also heard *1555-1750 (Anker Petersen, Denmark, DSWCI DX Window) A Farsi student listened to a recording and confirmed it is in Farsi, definitely not Dari. And it was Protestant religious, from Philadelphia, but no ID (Zacharias Liangas, Greece, *DX Listening Digest*)

Could be in both languages depending on time. If you look at the websites of missionary stations, you see that Afghanistan has become a very important target. Unlike Iran, Afghanistan is on the way to an open society with promising prospects for missionary work. But for some reason, these websites often refer to Farsi programs when they are talking about broadcasts to Afghanistan. Maybe they have problems finding Dari speakers. See <http://members.truepath.com/start> which discusses missionary broadcasting in Farsi (and Dari/Pashto) towards Afghanistan. And *Thru The Bible Radio*, <http://www.ttb.org> Another point against Iran as target area is the music selection of “Hit Shortwave”: Indian film music is extremely popular in Afghanistan, very little known in Iran (Bernd Trutenau, Lithuania, *DX Listening Digest*) Later on 4062.6, instead at 0218-0315, probably this, 4050 missing (Anker Petersen, Denmark, DSWCI DX Window)

MEXICO [and non] Colombia’s Voz de tu Conciencia on 6010v overrides R. Mil even here in Mexico City at 0530-0600. Another night between 0400 and 0500, jamming-like interference eliminated R. Mil and other stations 5 kHz above and below (Hector Garcia Bojorge, DF, *Conexión Digital*)

This is DRM, BBCWS via Sackville; see UK. I have urged the HFCC to recognize the existence of lowpower Mexican and Canadian SW stations which have occupied their inalterable frequencies for sesquicentades (gh) XEOI has been on SW more than 50 years, first with 250 watts, then 1000, 24 hours a day, and plans another increase to 10 kW, to cover all of Mexico and southern US. To avoid interference from these stations, our *Encuentro DX* on XEOI Radio Mil Onda Corta, 6010, has been rescheduled to: Fri 2325, Sat 1430, Sun 0130, 1500, 2325, Mon 0505 (Hector Garcia Bojorge, DF, *Conexión Digital*) Presumably one UT hour earlier whenever Mexico go on DST, when further adjustments may be necessary (gh)

NETHERLANDS Heads of departments have issued a formal reaction to the strategic plan of cuts at R. Netherlands [see last month]. They question the need for a ‘Big Bang’ approach. They disagree with the complete dismantling of the Portuguese section. They also disagree with the ending of special broadcasts for the Netherlands Antilles and Surinam. NVJ (the Dutch Journalists’ Union) and the CNV (the National Federation of Christian Trade Unions in the Netherlands) issued a joint statement describing the plan as ‘unacceptable.’ (© Radio Netherlands Media Network) Later:

The management, editor-in-chief and departmental heads at RN have agreed to break the impasse over proposed reorganization. Management have now formally withdrawn the plan in its original form. Heads of department and editor-in-chief Freek Eland will work on the details of a new plan for the future of RN. Their proposals will then be presented to management. The Dutch Union of Journalists welcomed the outcome (© Radio Netherlands Media Network 29 January 2003)

RN management tells us that its plans are not certain and that any comments or protests from listeners should be sent directly to the station (Célio Romais, Panorama, @tividade DX)

NETHERLANDS ANTILLES The limited series of special DRM tests from Bonaire 12025 0600-0655 to Au/NZ, being in-band, have wrecked reception of anything else between 12015 and 12040, as anticipated. This stuff is broadband in 20 kHz “spectrum blocks.” There are supposed to be masks to limit output, but this is not effective. These technology assessment tests ought to be out-of-band, or where they can do no damage (Bob Padula, Victoria, *DX Listening Digest*)

NIGERIA V. of Nigeria heard as early as Jan 9 testing 11770 around 2120-2245 sometimes heard in // to 15120 (Roland Schulze, Philippines, BC-DX) Looking for HCJB-Australia Feb 4 on new 11770, heard VON instead, \ 7255. VON had been announcing and listing 11770 for decades without using it (gh) I QSLed 11770 in 1978 (Craig Seager, Australia, ARDXC) Then heard on new 9690 at 0600 (Paul Ormandy, New Zealand, *DX Listening Digest*) An even longer-idle frequency, now mixing with DW. After a few days of trying these two new frequencies, reverted to usual 7255 and 15120, but expected new transmitters may bring them back to stay (gh)

PAPUA NEW GUINEA Wantok, Radio Light 93FM, the country’s first Christian Broadcasting network, hoped to raise 200,000 Kina to start a SW station in March. Late last year, also set up agreement with state broadcaster, NBC to carry 7 am and 7 pm news bulletins for its 300,000 strong audience (e-broadcast Asia via Richard Jary, Cumbre DX) Which relaying which?

PERÚ 5384.3, R. Huarmaca, is currently on the air at 1200-1600 and 2100-0100 M-F and 1200-0100 Sa/Su, 0.3 kW.

6479.7, R. Altura, Huarmaca, 1030-1500 and 1900-0200 daily, 1 kW.

6782.6, R. Ondas del Pacifico, Ayabaca, 2100-0300 M-F and 1900-0300 Sa/Su, 0.6 kW.

6956.8, R. La Voz del Campesino, Huarmaca, 2100-0100 M-F, 1900-0100 Sa, 1000-0100 Su, 1 kW.

7141.6, R. Real, Huarmaca, ceased about two years ago (Takayuki Inoue Nozaki, visiting Perú, Relámpago DX)

POLAND Media Magazine show on RP said that Radio Polonia would hold an extensive conference with the TPSA transmitting company about problems with quality of SW broadcasts. They would present reception reports, articles from

Shortwave Broadcasting

the internet and radio magazines, and MiniDisc recordings sent in by Erik Kæie in Denmark and ask for the technical problems at the site to be quickly rectified (Mike Barraclough, UK, World DX Club Contact)

SAUDI ARABIA BSKSA heard in Arabic on new 9715 at 0500-0600, frequency also used later in the day by Commando Solo (Erich Bergmann, Germany, BC-DX) Is definitely the only SW transmitter in Jeddah, 50 kW, replacing 11820 or 15435, \\ Riyadh 15170 and 21495. 9715 was also used until 1996 by Iraq's Mother of the Battles R. and R Baghdad (Wolfgang Bueschel, BC-DX) It's the Holy Kor'an Service at 0300-0600 (Observer, Bulgaria)

[non] At 2005-2035-(2130*2) Clandestine, Anti-Sa'udi, V. of Reform on 7590 replacing 9925, usual talks and phone-in programs in Arabic mentioning Bush and Palestine; jammed by Sa'udi Arabia. I suppose this is still via Kvitsøy, Norway (Anker Petersen, Denmark, BC-DX)

SERBIA AND MONTENEGRO ID heard closing English at 0129 on 7115, "The International Radio of Serbia and Montenegro" but they also continue use "Radio Yugoslavia" (Pat Rady, Ann Arbor, MARE)

SEYCHELLES David Bayliss of FEBC Philippines reports the main reasons for closing FEBA are: The antennae have come to the end of their useful life and it is too expensive to replace them. Also, housing is encroaching on the antenna site, bringing with it some concerns about electro-magnetic radiation from the antennae. Power and license costs are extremely high. It is felt that the wisest use of supporters' money is to close the station completely and buy time on the facilities of other broadcasters. It is anticipated that most of the transfer will take place by the end of June, depending on arrangements with suitable stations. David said that the BBC is also finding it very expensive to stay in the Seychelles, so it seems that they will close their station, but no timeframe is known for that (Robert Chester, Cheltenham, South Australia, EDXP)

TIBET [non] Voice of Tibet is registered: 1215-1300 on 15400 15615 15645 21495 21525 21635 21760, and 1430-1515 on 11550 11975 12025 12145. Uses CIS transmitter sites Almaty, Dushanbe and Tashkent, always object of strong jamming from China. But always on only two channels at 1215 and a single frequency at 1430 (Wolfgang Bueschel, Germany, DSWCI DX Window)

TOGO 5047 was heard in the early morning and evenings with strong signals. However, its extremely low audio level renders this an entirely pointless transmission (Chris Greenway, Ghana, World Of Radio)

UKRAINE/RUSSIA Heard news item on V. of Russia that VOR transmitters will transmit R. Ukraine programs to VOR audiences, and RU transmitters will transmit VOR programs to Ukraine audiences (Mike Parrish, Lexington KY, CIDX Messenger) Transmitters in Russia, would carry Ukrainian programs for listeners in Asia (VOR News, Jan. 27 2003 via Sosedkin) Actually, Ukraine has been relaying VOR on MW and SW for some time now. I guess Russia might restart the SW relays of RUI to the West Coast of North America (Sergei Sosedkin, IL, DX Listening Digest)

UAE UAE Radio from Dubai including English 1030, 1330 and 1600, moved in early Feb from off channel 21597.64 to 21605.27 (Graham Powell, Wales, Online DX Logbook) Finally closer to nominal 21605

UK [non] Looks like BBC plan to serve NAM on SW, using DRM. Began mid-Jan on 6010 at 00-01 and 04-05 (Magnus Wiberg, R. Sweden, dxing.info) This is Sackville. Main impact has been DRM hash on 6010 and nearby analog broadcasters, e.g., XEOL, which has occupied 6010 for sesquidecades; see Mexico (gh)

0000-0100 daily 6010 268 ENAm 250 70 BBCWS+ Sackville
0400-0500 daily 6010 253 WNA 250 70 BBCWS+ Sackville
+) temporarily a 5 minute tape loop. BBCWS relay will start soon
250 = analog power, 70 kW = DRM power

http://www.rnw.nl/realradio/html/drm_latest.html

European Music Radio tried a relay via Laser Radio, Latvia, 5935, Sunday Feb 9 at 1500 (Anker Petersen, DXLD) And at 1600-1700 on alternate Sundays at least through March 30 [or an hour earlier due to DST already then?] at 1600-1700, another ex-pirate, R. Marabu from Germany with *Gitarre X Radioshow*, <http://www.radiomarabu.de> - Europe's radio station for alternative music (via Mike Terry, DXLD) The next week at 1500-1600 *MediaSound* including *National Talking Express*, <http://www.mediasound.net> (Paul David, DX Listening Digest)

British Forces Broadcasting Service website revealed they had started a SW service to the ME in early Feb, 0200-0500 on 13720, 1500-1800 on 5945, but no info on sites (Kai Ludwig, Germany, DXLD) These were quickly monitored all over Europe, much better on the lower frequency, with lots of speculation about the site, including Austria, Cyprus, Oman, UAE (gh) BFBS Radio Two program (Mike Barraclough, UK, DXLD) Not Austria, since it signs on overlapping 5945 at 1759 (Kai Ludwig, Wolfgang Büschel) At 1700 pips, then BBC Radio 4 News and "PM" programme \\ 198 (but with half second delay). First time Radio 4 has been on shortwave in recent years? (Alan Pennington, Caversham UK, BDXC-UK) Website says reports go to marina.haward@bfbfbs.com (Dario Monferini, PLAYDX) The BFBS service is for personnel in an area from Northern Kurdistan near Dyrbakir, Turkey, to marines off the coast of Kuwait, Bahrain, UAE, and Oman (Wolfgang Büschel, Germany) Careful monitoring of 5945 with audio mix underneath revealed it is from Popovka site in Russia (Olle Alm, Sweden, DX Listening Digest)

USA Change of priorities at VOA and RFE/RL for fiscal year 2004, in accordance with Pres. Bush's budget request. \$30 million in start-up funds for Arabic-language satellite TV network; radio broadcasts in the strategic language of Indonesian will be doubled. Considering the economic climate of the times, international broadcasting fared well in terms of the FY '04 budget request. The President is

asking for an appropriation of \$563.5 million - a 9.5 percent increase over our FY '03 request.

But this means an end to most VOA and RFE/RL broadcasting to the democracies of Eastern Europe where free speech is practiced and where the process of joining the NATO alliance is underway. The closing of these services, whose employees have so gallantly served the cause of freedom, will bring a moment of sadness to many of us who saw victory in the Cold War as a direct result of these radios. But we should remember at the same time that the goal these services struggled and sacrificed for has been achieved, and they should take great pride in the role they played in this historic mission.

The total loss of 36 positions for VOA and 46 positions for RFE/RL, as well as 16 positions in IBB and administrative positions in RFE/RL, will be accomplished, where possible, by retirements, reassignments, and abolishing vacant positions. Unfortunately, it appears we also will face reduction-in-force to achieve these budget goals. Reduction of \$8.8 million from the FY 2003 request level would eliminate BBG broadcasting in nine languages and make cuts in others. VOA would no longer broadcast in Bulgarian, Czech, Estonian, Hungarian, Latvian, Lithuanian, Polish, Slovene, Slovak, Romanian. RFE/RL would no longer broadcast in Bulgarian, Croatian, Estonian, Latvian, Lithuanian, Slovak (from a statement by Kenneth Y. Tomlinson, BBG chairman)

The BBG budget calling for cutting several VOA and RFE/RL languages is not final; subject to debate, and Congress could exempt some of the proposed cuts. This has happened in the past (Kim Elliott, VOA Main Street)

VOA launched a new, five-day-a-week, half-hour English-language program for Zimbabwe called *Studio 7* Jan 27, on SW and MW at 1730-1800, and on demand at <http://www.voanews.com/EnglishToAfrica>. VOA Director David Jackson said, "Free, credible and unbiased information is sorely needed in Zimbabwe to counteract the government repression of media there." The VOA Zimbabwe Broadcasting Project, which will expand to one hour every day with programming in English, Shona, and Ndebele, is funded by a grant from USAID. (VOA press release) heard on 17895 from Morocco, 13600 from Botswana (Alan Pennington, Caversham UK, World Of Radio)

VOA doubled its Kurdish language broadcasts Jan 15 from one to two hours daily to Iraq and the surrounding countries. The new broadcast at 1800-1900 supplements the one at 1600-1700 (VOA Press release) Add another VOA hour in Kurdish: 0400 on 7200, 9705, 15115.

VOA also doubled time in Korean, to 1200-1400 on 5985, 7235, 9555, 11895 extended, and 2100-2200 5995, 7110, 12065 (Ivo and Angell Observer, Bulgaria)

VOA zip codes, old and new: The State Department mail room says it will no longer forward to VOA letters with the 20547 zip code. In 1998, the U.S. Information Agency was absorbed into the State Department; State kept 20547, with VOA/IBB/BBG assigned the new zip code 20237 (Kim Elliott, DC, VOA, DX Listening Digest)

WBCQ has inaugurated our own news service, *Planet World News*, compiled by our staff as honestly, sincerely presented, truthful and accurate world news stories as we can obtain, Mon-Sat 2050-2100 on 7415, M-F also on 9335-CUSB. *Laser Radio* from Britain is also added to WBCQ Sundays 2000-2400 on 9335 (Allan H. Weiner, DX Listening Digest) If continuing into April, DST would shift these to start at 1950 and 1900. Initially, PWN would be missing on certain days. The first *Laser Radio* broadcast Feb 16 included a *Media Show*, mostly about offshore and British affairs, at 2000, the only hour overlapping their previously started transmission via Latvia 5935. There was to be a new *Media Show* every fortnight, and repeated the following week at different times (gh, Mike Terry)

New on WRMI from late Jan, UT Mons 0500-1000 on 7385, *Jupiter 400*, International Mélange of Talk and Music, a 5 hour live variety show with music, phone interviews, powerful commentary, talk and comedy bits. Hosts Susan and the Bee Man guide you through the Jupiter 400 experience. Send reception reports and e-mail to: shows@jupiter400.net Part of the time block includes the *Edge of Reality* hosted by Dr. Wayne E. Haley, a professional psychoanalyst and paranormal researcher specializing in UFO abductions <http://radio.jupiter400.net> (WRMI website) If still going in April, DST would shift it to 0400-0900 UT

[non] Family Radio reaches mainland China from a station in Taiwan and is building a station to reach much of Southeast Asia (From an article on Harold Camping, *Religion Today*, Associated Press via Ullis Fleming, <http://www.radiointel.com> and via Andy Sennitt, Brock Whaley) AP didn't think WYFR worth mentioning, and a growing SW relay network. But what, other than Taiwan, is this new station, on SW? (gh)

VENEZUELA Horse racing is second in popularity here only to baseball. Coverage of races Wed-Sat can be heard on 5593.95 USB, at times such as 0035, 0100, 0127, 0156, but they last only a couple of minutes and the frequency is otherwise silent. Could be feeder for broadcast by other stations, or for illegal betting parlors (Adán González, Catia La Mar, DX Listening Digest)

ZAMBIA Radio One, 6265, at 1735. What a joy is this very entertaining station with local reception quality (useful to have Zambia at the antipode to Hawaii!). Loud 5-5-5 signal many hours after my local sunrise. Very lively African music. 1759 an amusing ad for 'Handyman's Paradise'. 'Hurry, hurry, limited stock'. They sponsor the English news at 1800 which is carried on both networks (R1 on 6265 and R2, the English network on 6165). Both frequencies exceptionally strong. This is my choice for pleasant background music! (Walt Salmani, visiting Maui, DX Listening Digest)

Until the Next, Best of DX and 73 de Glenn!

0009 UTC on 2390

MEXICO: Radio Huayacocotla. Spanish service alternating brass band and marachi tunes. SIO 453. **Radio Mill** 6010, 0015. (Harold Frodge, Midland, MI; Bob Wilkner, Margate, FL/Hard-Core DX) **Radio Educacion** 6185, 0025. (Stewart MacKenzie, Huntington Beach, CA)

0040 UTC on 7325

LITHUANIA: Radio Vilnius. Good signal quality for English segment on Vilnius betting parlors. (Jill Dybka-KF4ZEO, Kingston Springs, TN) 7325, *0030-0059*. IDs, news and features. (Kraig Krist-KG4LAC, Annandale, VA)

0100 UTC 9640

PORTUGAL: Deutsche Welle relay. DW Radio News, News Link and German language radio course. SIO 555. (Krist, VA)

0110 UTC on 7115

SERBIA/MONTENEGRO: Radio Yugoslavia. Segment on local superstitions. Fair signal for station identification to Europe and North America. (Dybka, TN)

0147 UTC on 6950

PIRATE: Undercover Radio 0147. Laurie Anderson's music and poetry. (Dybka, TN) The **Int'l Silly Channel** 27555, 2020-2115+. (Frodge, MI) **KIPM** 6925, 0131. (Krist, VA)

0259 UTC on 9525

SOUTH AFRICA: Channel Africa. Station ID with Johannesburg reference, "This is Channel Africa calling you." SIO 252. 17870, 1802 SIO 454. (Krist-VA)

0308 UTC on 7400

BULGARIA: Radio. Newscast to press review. SIO 433 with utility interference. (Krist, VA) 7400, 0055. (MacKenzie, CA; McGuire, MD) 7400, 0018-0025+ (Frodge, MI)

0500 UTC on 6085

GERMANY: Bayerischer Rundfunk. Opening without interval signal but with station identification. SINPO 44434. Heard 1920-2300* on subsequent days. Interference from Deutsche Welle German service 6075, and Chinese service on 6085. (Anker Petersen, Denmark/DXLD)

0525 UTC on 4770

NIGERIA: Radio Nigeria. End of news, ID and local time check. Afro pops to choral music and religious format. (Scott R Barbour JR, Intervale, NH/Cumbre DX)

0558 UTC on 4835

MALI: RTV Malienne. National anthem to ID over music "Radiodiffusion Television Malienne." Sign-on mention of Bamako with choral music. (Barbour, NH)

0606 UTC on 6100

LIBERIA: Radio Liberia Intl. Morning devotional to up-tempo music. Continuous Afro-pop music, 0725 religious format to full ID, time check. (Jerry Berg, MA/NASWA Flash Sheet) 6100, 0707. (Dybka, TN) **Radio Veritas** 5470, 0637-0654. (Barbous, NH; Duane Hadley, Bristol, TN)

0745 UTC on 11675

NEW ZEALAND: R. NZ Intl. Commentary on the Turkish-Iraqi trade. (Fraser, MA) 17675, 0343. (MacKenzie, CA)

0750 UTC on 7125

GUINEA: RTV Guinienne. Fair signal for French service including male/female duo's pop show. (Dybka, TN)

0850 UTC on 590

BRAZIL: Radio Senado de la Nacion. Station ID to Portuguese greetings to listeners in Para and Rio Grande do Sul states. Local time check to commentary. SINPO 34443. (Arnaldo Slean, Buenos Aires, Argentina) **Radio Nacional Sao Gabriel** 3375, 0932-1005. (Rich D'Angelo, PA) **R. Nacional** 4915, 0554-0603. Barbour, NH)

1030 UTC on 6010

COLOMBIA: La Voz de tu Conciencia. Spanish religious talk and hymns with S7 signal. 6010, 0001+ (Slaen, ARG) **Caracol Villavicencio** 5960v, 0930. (Fernando Garcia, Baltimore, MD) **R. Melodia** 6140.5, 0340-0415. (D'Angelo, PA)

1047 UTC on 5039.18

PERU: Radio Libertad de Junin. Closing talks in Spanish into Peruvian music. Mentions of "Junin," time check, and commercial block. Bad interference. (Dave Valko, PA/Cumbre DX)

1055 UTC on 4782v

ECUADOR: Radio Oriental. Spanish public service announcements to time check and ID. (Garcia, MD) **HCJB** 11895, 2125. (Fraser, MA) **HCJB** 9745, 0105. (MacKenzie, CA)

1115 UTC on 4832

HONDURAS: Radio Litoral. Spanish. Dr. Luis Palau-Responde, answering listener's letters. ID into religious sermon and ID. (Garcia, MD) 4832, 0250-0320 with utility interference. (Brian Bagwell, St. Louis, MO) **R. Luz y Vida** 3250, 1210-1225. (Hadley, TN) **R. International** 4930.64, 1147-1238 (Valko, PA/)

1244 UTC on 4890

PAPUA NEW GUINEA: NBC Sixties pop tunes to announcer's chat. SIO 353. (Krist, VA; Valko, PA) **R. Enga** 2410, 1003; **R. Morobe** 3220, 1005; **R. Manus** 3315, 0947. (Bob Montgomery, PA) **R. Sandaun** 3205, 1124; **R. West New Britain** 3235, 1143; **R. Madang** 3260, 1143; **R. Southern Highlands** 3275, 1142; **R. Western** 3305, 1124. (Jerry Lineback, KS/Cumbre Flash Sheet)

1253 UTC on 3325

INDONESIA: RRI-Palangkarya. Indonesian. Announcer to "Song of the Coconut Islands" interval signal at 1159; **RRI-Ternate** 3345, 1254; **RRI Pontianak** 3976, 1259; **RRI-Makassar** 4753.3, 1301; **RRI-Irian Jaya** 4789, 1302 (Lineback, KS) **Voice of Indonesia** 15149.8, 2032-2044+. (Frodge, MI)

1335 UTC on 21597

UAE: Emirate Radio. News and weather from Dubai, followed by *Islamic Traditions Through the Ages* feature. SIO 252. (Krist, VA)

1440 UTC on 9425

INDIA: All India Radio. Commentary on gender equality in India and education in rural areas. Unusually good at an S9 signal level. (Gil Aiken, WA) **AIR-Aligarh** 9910, 2121-2132+. (Frodge, MI) **AIR-Bangalore** 11620, 1910. (McGuire, MD; Frodge, MI; Krist, VA) **AIR-Delhi** 6155 // 9595, 0113. (MacKenzie, CA) **AIR-Hyderabad** 4800, 1230. (Frank Hillton, Charleston, SC) **AIR-Thiruvananthapuram** 5010, 0015. (Garcia, MD) **AIR-Lucknow** 4880, 1224; **AIR-Jaipur** 4910, 0147; **AIR-Ranchi** (tent.) 4960, 1227. (George Maroti, NY/NASWA Flash Sheet)

1550 UTC on 11710

NORTH KOREA: Voice of Korea. Slanted editorial on the United States. (Fraser, MA) 11735, 0100. (Krist, VA) South Korea's **Radio Korea Int'l** 3955, 2211-2230*. (Frodge, MI)

1600 UTC on 11715

USA: KJES. Frequency announcement to religious music and text with IDs for Spanish service. **WJIE** 7490, 1600-1615 with faint signal but readable. **Radio Marti** Spanish 21675, 1915-2000. (Joe Wood, Gray, TN) 21675, 2140. (MacKenzie, CA) **AFRTS** 12689, 1845; **WBCQ** 7415, 2300. (Fraser, MA) **Voice of America** news 7405, 0011. (MacKenzie, CA) **VOA** 4960, 0344-0408. (Krist, VA)

1630 UTC on 17545

ISRAEL: Kol Israel. Interval signal, time pips to ID. Report on Palestinians. (William McGuire, Cheverly, MD) 11605, 1737-1745+ (Frodge, MI) 11605 // 15640, 2018. (Fraser, MA) **Galei Zahal** 15785, 1443-1500+. (Frodge, MI) 7545 // 11585, 0125. (MacKenzie, CA)

2013 UTC on 11715

CLANDESTINE: Saudi Arabia-Voice of Iraqi People. Arabic text to English station ID, as "Voice of Iraqi People." Signal good with no interferences, and minimal fading to abruptly off in mid sentence at 2029. (Wood, TN)

2140 UTC on 7190

TUNISIA: RTV Tunisienne. Middle Eastern music to listener's phone-in during Arabic service. Mentions of "Tunis" during identification at 2158. (Wood, TN) 7190, 2205. (McGuire, MD) 7275, 0408 with Arabic service. (MacKenzie, CA)

2145 UTC on 4915

GHANA: GBC. Time pips to drum interval signal and highlife music. Regional news and items on local job applications. Signal improved by closing broadcast. ID as "Radio Ghana." (Wood, TN)

2205 UTC on 7405

Radio Stathmos Makedonias. Greek music on mandolin as part of Greek service. Very good reception. (Wood, TN) 7430, 2200 Greek to 2251*. (Garcia, MD) **Voice of Greece** 9425, 2110. (MacKenzie, CA)

Thanks to our contributors – Have you sent in YOUR logs?

Send to Gayle Van Horn, c/o Monitoring Times (or e-mail gaylevanhorn@monitoringtimes.com) **Please note:** paper strips and cassette recordings will no longer be accepted.

English broadcast unless otherwise noted.

Radio Prague releases new QSL card

For you collectors, Radio Prague has a new color QSL card. This new card features a color photograph of a 1953 JAWA 500 motorcycle - possibly a new series of cards? You may report via their website form at <http://www.radio.cz/en/report> (or) Czech Radio, Vinohradska 12, 12099 Prague 2, Czech Republic.

Check out the HCJB website <http://www.hcjb.org>. Here you'll find info on their current *Ecuadorian Scenic Coast* QSL series, or previous card issues still available for the asking.

From *DX Listening Digest*,



comes word that religious broadcaster FEBA will be closing their Seychelles station during 2003, possibly by the end of June. Reasons range from, "antennas have come to the end of their useful life and it is too expensive to replace," plus "housing problems at the antenna site and license and power cost are extremely high." This may be your last opportunity to verify Seychelles, and I would highly recommend you do so. Send your report to: P.O. Box 234, Mahe, Seychelles, Indian Ocean. What a shame to add Seychelles to our on-going list of ever-shrinking shortwave broadcasters.

AMATEUR RADIO

EASTER ISLAND-CE0Y/DM5TI, 10 meters SSB. Full data color card. Received in ten months via ARRL bureau. (Jilly Dybka, KF4ZEO, Kingston Springs, TN)

LORD HOWE ISLAND-VK9YL (OC-004), 20 meters SSB. Full data color picture postcard via QSL Manager VK3DL GwenTilson. Received 63 days for a Euro nested airmail envelope set and one US dollar. All female DXpedition. QSL Manager's address: 3 Gould Court, Mt Waverley, Victoria 3149 Australia. (Larry Van Horn, N5FPW, NC)

VANUATU-YJ8UU (Efate OC-35), 20 meters SSB. Two color full data cards via QSL Manager ZL2HE, A.E. Law. Received in 70 days for a Euro nested airmail envelope and one US dollar. QSL Manager's address: 68 Ruahine Street, Dannevirke 5491, New Zealand. (Van Horn, NC)

MADEIRA ISLAND-CT3BX, 10 meters SSB. Full data QSL card. Received in ten months via ARRL bureau. (Dybka, TN)

SPAIN-EA1EXE, 15 meter CW. Full data color QSL card. Received in one year via ARRL bureau. (Dybka, TN)

ARGENTINA

RAE, 15345 kHz. Full data logo QSL card in German, signed by Rayen Braun-Deutsche Redaktion & Marcela G.R. Campos-Director. Personal letter enclosed by verie signer. Received in 345 days for a report and one IRC. Return envelope had 21 Argentine stamps. Station address: Casilla 555, C1000 WAF Buenos Aires, Argentina. (Martin Schoech, Germany/Cumbre DX/DXLD)

BRAZIL

Radio Congonhas, 4755 kHz. Full data verification letter with illegible signature, plus station sticker enclosed with calendar and tourist brochure. Received in 20 days for a Portuguese report. Station address: Praca da Basílica 130, Congonhas, MG Cep 36.404-000 Brazil. (Arnaldo Slaen, Buenos Aires, Argentina)

CONGO DEM. REP.

Radio Okapi, 9550 kHz. Full data QSL card

unsigned. Received in five months. Address on card: Foundation Hirondelle, 3 Rue Traversiere, 1018 Lausanne, Switzerland. (Slaen, ARG) This station is broadcast through a joint project involving the United Nations Mission in the Democratic Rep. Of Congo, and the Swiss-based Foundation Hirondelle. Website: <http://www.monuc.org/radio>. - GVH

ECUADOR

HCJB, 9745 kHz. Full data QSL from series *Ecuadorian Scenic Coast*, signed by John Beck-Station Manager. Received in 35 days for an English report and three US mint stamps. Station address: English Service, Casilla 17-17-691, Quito, Ecuador. (John Vercellino, Downers Grove, IL)

GHANA

Guyana Broadcasting Corp., 3291.25 kHz. Date and frequency verification form letter, signed by Winston Carr-Maintenance Engineer-Transmitters. Info sheet on Ghana enclosed. Received in two months for a taped report and two IRCs. Letter was mailed from Cuba. Station address: Broadcasting House, P.O. Box 10760, Georgetown, Guyana. (Joe Talbot, Red Deer, Alberta, Canada/Cumbre DX/DXLD)

MEDIUM WAVE

CJRL, 1220 kHz AM. Verification letter signed by Hugh Syrya-Manager. Received in 22 days for a taped report and one US dollar. Station address: 128 Main Street, South-Kenora, Ontario, P9N 1S9 Canada. (Patrick Martin, Seaside, OR)

KFTI, 1070 kHz AM. Conformation and signature written on my reception report, signed by Jeanenne-Executive Administrative Asst. Bumper stickers and business cards enclosed. Received in 20 days for an AM report and one US dollar (returned with reply). Station address: 4200 N. Old Lawrence Rd., Wichita, KS 67219-3299. (Patrick Griffith, Westminster, CO)

KSPN, Pasadena, CA., 1110 kHz AM. Brief no data email QSL verification. Also mention they have moved to 710 AM. No veri signer on reply. Email address: ESPNRadio1110@listenerclub.com. (Martin, OR)

KTIQ, 1660 kHz AM, Merced, CA. Verification written on the back of a station bumper sticker with an illegible signature. Received in eight days for an AM report. Station address: 514 E. Bellevue Rd., Atwater, CA 95301. (Martin, OR)

NORTH KOREA

Voice of Korea, 6575 kHz. Full data QSL card (transmitter site not included) with illegible signature. Magazine, newspaper, pin and personal letter enclosed. Received in 57 days without return postage. I first heard this station 15 years ago! Station address: External Service, Korean Central Broadcasting Station, Pyongyang, Democratic People's Republic of Korea. (Schoech, Germany/Cumbre DX)

PERU

Radio San Antonio, 4940 kHz. Full data card and *Certificado de Sinotonia* certificate, signed by Juan Lopez Encinas-Director, plus a souvenir post card and friendly letter about the station and city of Ucayali. Received in 113 days for a Spanish report. Station address: Calle Iquitos 499, Atalaya, Ucayali, Peru. Email: rasar@terra.com.pa (Slaen, ARG)

Radio Melodia, 5940 kHz. Full data prepared QSL card signed by Hermogenes Delgado Torres-Gerente, plus two station stickers. Received in 15 weeks for a cassette tape, mint stamps (not used) and an SAE (used for reply). Station address: San Camilo 501, Arequipa, Peru. (John Sgrulletta, Mahopac, NY/Cumbre DX)

USA

WRNO, 7355 kHz. No data letter signed by Robert E. Mawire-Chairman of the Board. Received in 37 days for an SASE. Note included, "we are the proud owners of WRNO Worldwide, and all the former encumbrances have been cleared." Also notes, "that they are raising cash for a new transmitter, the old one caught fire just after they bought the station, so they are running on low power for the time being." Station address: P.O. Box 895, Ft. Worth, TX 76101. (Scott Barbour, NH/DXLD)

"Gone," But Not Unheard

Deutsche Welle has ended its direct shortwave broadcasts to North America. DW joins the BBC World Service, Swiss Radio International, Radio France Internationale, Radio Australia and Channel Africa on a list of international broadcasters that retain prominent English language services, but no longer target North America (and other English speaking regions) with shortwave frequencies.

Yet, nearly all of these stations continue to be heard – sometimes quite well – on shortwave in North America. How do they do that?

Thank the ionosphere. Fortunately, short-wave signals will not be confined to targeted areas. Because of the exigencies of radio signal propagation and transmission techniques, short-wave signals will “hop” beyond their primary intended targets, partially radiate off the back end of directional transmitters, travel a “duct” that forms roughly along the “terminator” or line that moves across the globe separating darkness from light, night from day – and perform other feats of wonder that still defy comprehensive and conclusive scientific explanation.

◆ A DXer in All of Us?

To many, believe it or not, this is all part of the attraction of shortwave listening. DXers, those brave explorers who chase down the most elusive signals, have known about and studied shortwave propagation since the beginning of the radio broadcasting era. Through this study, DXers learn when they are most likely to capture these signals – even ones that are of such extremely low power that the uninitiated would never guess such reception is possible, let alone predictable.

Of course, for a DXer, the quest is to capture a radio signal perhaps only once, but in such a way that the broadcast can be unquestionably logged and possibly verified in writing by the station. The program listener seeks considerably more reliable – and listenable – reception so that favorite programs can regularly be heard. Therefore, if he or she is going to be able to continue to hear stations no longer offering direct shortwave service, it would be helpful to learn something about shortwave propagation.

Several broadcasters use “offshore” relay transmitters to reach intended targets. Depending on how these transmitters are “slewed,” some emitted signals may continue on to North America if:

- the latter is on or near the same heading as (or in some cases directly opposite) the intended target;

- the power used is adequate; and,
- ambient propagation conditions are good.

To be sure, reception will be somewhat less reliable than it would be if North America were a direct target. However, in many cases the difference may be only marginal. This will be especially so if your receiver is of higher quality and has the benefit of an outside aerial. As we have explained in these pages before, in the case of the BBC, broadcasts intended for Europe and Africa usually will give better results in the eastern half of North America and those targeting Asia will perform more reliably for the western half of the continent. Experimentation is encouraged – and necessary! Refer to the frequency section of *MT's Shortwave Guide* and try them all.

Deutsche Welle

(<http://www.dwworld.de>)

Since DW represents the most immediate example, we'll start here.

Although no longer via shortwave, DW continues to target listeners in North America:

- directly via its own Internet site and via satellite;
- indirectly via the World Radio Network (where, incidentally, many other international broadcasters also can be heard) on the Internet (<http://www.wrn.org>) and satellite – including Sirius Satellite Radio, channel 115;
- on AM and FM radio across Canada via *CBC Radio Overnight* and on scattered U.S. public radio stations.

The English Service is to operate around the clock (on shortwave also, except for 0100-0400 UT) and increase its transmissions to one full hour – extending some popular programs to 30 minutes, whilst adding new features (see Programming Notes on page 55).

Some shortwave broadcasts to other regions undoubtedly will provide acceptable reception in North America. Specific frequencies for the spring/summer season were unavailable at press time (mid-February). Historically, however, transmissions directed to Africa from the Kigali Rwanda and Sines Portugal relay sites have put good signals into at least the eastern half of North America and often beyond. Here are some educated guesses for the coming season:

0400 - 7225, 12045
0600 - 11925, 13790, 17860
1900 - 11805, 15390
2100 - 9875, 15135

There also will be new transmissions to Africa at 0500 and 2000. Former transmissions to Africa at 0900, 1100, and 1600 apparently

have been dropped. The schedule to Asia also has been increased and extensively revised. Transmissions to Asia now air at 0000, 1000, 1100, 1200, 1600, 2200 and 2300 and the best frequencies for the West Coast are likely to be those originating from the Trincomale, Sri Lanka, relay targeting southeast Asia. Broadcasts to the region at 0100, 0200, 0900 and 2100 have been dropped. All such broadcasts to Australasia also have been discontinued.

Swiss Radio International

(<http://www.swissinfo.org>)

SRI's half hour broadcasts are heard very reliably in my shack (in upstate New York) and throughout the continent on most of their listed frequencies at 1730, 1930, 2000 and 2330.

Channel Africa

(<http://www.channelafrica.org>)

The South African international broadcaster's transmissions to West Africa often put fine signals into at least eastern North America from the modern and powerful Meyerton facilities.

0500 - 11710
0600 - 15215
1300-1455 - 21725
1700 - 17860
1800 - 17870

Radio Australia

(<http://www.abc.net.au/ra>)

Reception is easier and more reliable as one moves west across the continent. However, morning reception on 9580 in eastern zones is always good to excellent. Furthermore, acceptable late afternoon (21740) and nighttime reception (15515, but also 15240 and 17580) becomes possible almost daily in the east as we move toward midsummer. In general, frequencies targeting the Pacific (especially on or near a 70 degree azimuth) should be checked.

Radio France Internationale

(<http://www.rfi.fr>)

For a station with such a prominent presence elsewhere, RFI's English Service is often annoyingly difficult to monitor in North America on shortwave, especially during the summer months. Transmissions are scheduled at 1200 (30 min.), 1400 (one hour), 1600 (90 min.) daily and 0400, 0500, 0600, 0700 (all 30 min.) weekdays. Check all listed frequencies – sometimes you get lucky.

Until May, good listening!



HOW TO USE THE SHORTWAVE GUIDE

0000-0100 twhfa USA, Voice of America 5995am 6130ca 7405am 9455af
 ① ② ⑤ ③ ④ ⑥ ⑦

Convert your time to UTC.

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Daylight Time) 4, 5, 6 or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each page.

Note that all dates, as well as times, are in UTC; for example, a show which might air at 0030 UTC Sunday will be heard on Saturday evening in America (in other words, 8:30 pm Eastern, 7:30 pm Central, etc.).

Find the station you want to hear.

Look at the page which corresponds to the time you will be listening. On the top half of the page English broadcasts are listed by UTC time on ①, then alphabetically by country ③, followed by the station name ④. (If the station name is the same as the country, we don't repeat it, e.g., "Vanuatu, Radio" [Vanuatu].)

If a broadcast is not daily, the days of broadcast ⑤ will appear in the column following the time of broadcast, using the following codes:

Day Codes

s/S	Sunday
m/M	Monday
t/T	Tuesday
w/W	Wednesday
h/H	Thursday
f/F	Friday
a/A	Saturday
D	Daily
mon/MON	monthly

In the same column ⑤, irregular broadcasts are indicated "tent" and programming which includes languages besides English are coded "vl" (various languages).

Choose the most promising frequencies for the time, location and conditions.

The frequencies ⑥ follow to the right of the station listing; all frequencies are listed in kilohertz (kHz). Not all listed stations will be heard from your location and virtually none of them will be heard all the time on all frequencies.

Shortwave broadcast stations change some of their frequencies at least twice a year, in April and October, to adapt to seasonal conditions. But they can also change in response to short-

term conditions, interference, equipment problems, etc. Our frequency manager coordinates published station schedules with confirmations and reports from her monitoring team and MT readers to make the Shortwave Guide up-to-date as of one week before print deadline.

To help you find the most promising signal for your location, immediately following each frequency we've included information on the target area ⑦ of the broadcast. Signals beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible.

Target Areas

af:	Africa
al:	alternate frequency (occasional use only)
am:	The Americas
as:	Asia
au:	Australia
ca:	Central America
do:	domestic broadcast
eu:	Europe
irr:	irregular (Costa Rica RFPI)
me:	Middle East
na:	North America
om:	omnidirectional
pa:	Pacific
sa:	South America
va:	various

Choose a program or station you want to hear.

Selected programs for prime listening hours appear following the frequencies – space does not permit 24 hour listings nor can every station be listed. However, listings for the most popular stations and selected lesser-known stations illustrate the variety available on shortwave. The format of the listings alternates among three different styles – by station, by genre and by day – month by month. Times listed are approximate and programs are subject to change.

The program listings emphasize broadcasts targeted to North America. In most cases, the stations and programs listed should be readily receivable in North America using a portable radio. Most broadcasters produce one broadcast in English per day that is repeated over a 24 hour period to all areas. If you are able to listen to transmissions to other areas of the world during "non-prime time" hours, referring to the prime time listings for those stations will likely be helpful in determining what programs will be broadcast.

Occasionally, a program or station listing may be followed by a reference to another listing for the same program or station at a different time. This is done to conserve space and make it possible to provide more listings.

MT MONITORING TEAM

Gayle Van Horn John Figliozi
 Frequency Manager Program Manager
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Mark Fine, VA
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Program Highlights

John Figliozi

Deutsche Welle

Just like that, DW has dropped its English Service shortwave broadcasts to North America and Australasia, aping another well-known broadcaster. Budget problems are truly the catalyst in DW's case; but – given the redundancy (6 hours, multiple repeats, 14 frequencies) in its prior schedule – arguably something could (and should) have been salvaged with significant savings still realized. Alternative media (internet, local placement, satellite) remain inadequate direct substitutes, regardless of management protestations to the contrary. But...

See *Programming Spotlight* for DW broadcasts to other areas that could still afford adequate reception here. DW also has engineered a significant set of other changes. Each transmission is now an hour, with some existing features time-extended and new ones added.

Newslink: Hourly M-F (T-A 0000-0600 editions) at :05. Live every 3 hours from 0700. Regional editions—Asia at 1005, 1105, 1205, 1605, 1705, 2205, 2305, 0005; Africa at 2005, 0405, 0505, 0605.

S-F Hourly Features: (*italics* = 1 day later UT)
 1600, 1800, 2000, 2200, 0000, 0200, 0400, 0600:
 S-Mailbag; M-Insight, Business German; T-Arts on the Air; W-Money Talks; H-Man & Environment; F-Spectrum;
 1700, 1900, 2100, 2300, 0100, 0300, 0500: S-Sport, Inspired Minds, Hits in Germany/Melody Time; M-World Music Live; T-World in Progress; W-Living in Germany & Europe on Stage; H-Cool; F-Focus on Folk;
 0700, 0900: S-Sport, Inspired Minds, Hits in Germany/Melody Time; M-Spectrum; T-World Music Live; W-World in Progress; H-Living in Germany & Europe on Stage; F-Cool!
 1000, 1200, 1400: as 0700, 0900 except M-Focus on Folk.
 0800: S-Mailbag; M-Focus on Folk; T-Insight, Business German; W-Arts on the Air; H-Money Talks; F-Man & Environment.
 1100, 1300: as 0800 except M-Spectrum.
 1500: as 0800 except S-Concert Hour; M-Spectrum.

Saturday Features:
 0705, 0905, 1105, 1405, 1705, 1805, 2005, 2205, 0105, 0405, 0605: Inside Europe.
 0805, 1505, 0205: Religion & Society; German by Radio; Network Europe.
 1005, 1205, 1605, 2305, 0005: as 0805 except Asia This Week replaces Network Europe.
 1905, 2105, 0505: as 0805 except Africa This Week replaces Network Europe.
 1305, 0305: Concert Hour.



0000 UTC - 8PM E / 7PM C / 5PM P (daylight savings time)

0000	0015	Cambodia, National Radio Of	11940as			
0000	0015	Japan, Radio	6145na	13650as	17810as	
0000	0030	Egypt, Radio Cairo	9900am			
0000	0030	mtwhf/vl	Solomon Islands, SIBC	5020do	9545do	
0000	0030		Sri Lanka, SLBC	4940as		
0000	0030		Thailand, Radio	9680va		
0000	0030		UK, BBC World Service	3915as	5970as	11945as 17615as
0000	0045		India, All India Radio	9705as	9950as	11620as 13605as
0000	0055		Spain, R Exterior Espana	6055am		
0000	0057		Canada, Radio Canada Intl	9755as	11895as	9755as 11895as
0000	0059		Canada, Radio Canada Intl	5960na	9590na	
0000	0100		Anguilla, Caribbean Beacon	6090am		
0000	0100		Australia, ABC NT Alice Springs	4810eu	9960eu	
0000	0100		Australia, ABC NT Katherine	5025do		
0000	0100		Australia, ABC NT Tennant Crk	4910do		
0000	0100		Australia, Radio	5995va	9475as	9580va 9660pa 11650va
			11660as 12080va	15240pa	15415as	17775as 17580pa 17795va
			21725va			
0000	0100		Bulgaria, Radio	7400na	9400na	
0000	0100		Canada, CBC Northern Service	9625do		
0000	0100		Canada, CFRX Toronto ON	6070do		
0000	0100		Canada, CFVP Calgary AB	6030do		
0000	0100		Canada, CKZN St John's NF	6160do		
0000	0100		Canada, CKZU Vancouver BC	6160do		
0000	0100		Costa Rica, R for Peace Intl	7445am	15040am	
0000	0100		Costa Rica, University Network	5030am	6150am	7375am 9725sa
			11870am 13750na			
0000	0100		Germany, Deutsche Welle	6040am	6145am	9640am 9700na
			9765na			
0000	0100		Guyana, Voice of	3290do	5950do	
0000	0100		Malaysia, Radio	7295do		
0000	0100		Namibia, NBC	3270af	3290af	
0000	0100		Netherlands, Radio	6165na	9845na	
0000	0100		New Zealand, Radio NZ Intl	17675pa		
0000	0100		Russia, University Network	9890as		
0000	0100		Singapore, SBC Radio One	6150do		
0000	0100		UAE, AWR	6035as	6055as	
0000	0100		UK, BBC World Service	5975va	6195as	7105as 9410va 9825sa
			11955as 12095va	15280as	15310as	17790as
0000	0100		USA, Armed Forces Network	3903usb	4278usb	4319usb 4993usb
			6350usb 6458usb	10320usb	12579usb	12689usb 13362usb
			USA, KAUJ Dallas TX	5755va		
0000	0100		USA, KTBN Salt Lk City UT	7505na		
0000	0100		USA, KWHR Naalehu HI	17510as		
0000	0100		USA, Voice of America	7215va	9890va	11760va 15185va 15290va
			17740va 17820va			
0000	0100	tw hfa	USA, Voice of America	5995am	6130am	7405am 9455am 9775am
			11695am 13710am			
0000	0100		USA, WBCQ Kennebunk, ME	7415na	9335na	11660na
0000	0100		USA, WEWN Birmingham AL	5825na		
0000	0100		USA, WHRA Greenbush ME	7580va		
0000	0100		USA, WHRI Noblesville IN	5745va	7315am	
0000	0100		USA, WINB Red Lion PA	12160am		
0000	0100		USA, WJIE Louisville KY	7490am	13595am	
0000	0100	sm	USA, WRMI Miami FL	9955am		
0000	0100	tw hfa	USA, WRMI Miami FL	7385na		
0000	0100		USA, WRNO New Orleans LA	7355am		
0000	0100	as	USA, WSHB Cypress Creek SC	9430am		
0000	0100	wf	USA, WSHB Cypress Creek SC	9430am	15285am	
0000	0100		USA, WTJC Newport NC	9370na		
0000	0100	sm	USA, WWBS Macon GA	11900na		
0000	0100		USA, WWCN Nashville TN	3210na	5070na	5935na 7465na
0000	0100		USA, WWRB Manchester TN	5050na	5085na	6890na
0000	0100		USA, WYFR Okeechobee FL	6085na	9505na	11720na
0000	0100	vi	Vanuatu, Radio	3945al	7260do	
0000	0100		Zambia, Christian Voice	4965do		
0000	0130		UAE, Gospel For Asia	6145as		
0005	0012		Croatia, Croatian Radio	9925sa		
0030	0100		Australia, Radio	17750as		
0030	0100		Iran, VOIRI	6015am	6120am	9580am
0030	0100		Lithuania, R Vilnius	7325na		
0030	0100	as	Russia, Bible Voice BC	12035as		
0030	0100	as	Russia, Bible Voice BC	12035as		
0030	0100	as/vl	Solomon Islands, SIBC	5020do	9545do	
0030	0100		Sri Lanka, SLBC	4940as	6005as	6075as 9770as 15745as
0030	0100		Thailand, Radio	13695na		
0045	0100		Pakistan, Radio	11655as	15455as	
0055	0100		Italy, RAI Intl	9675na	11800na	

0100 UTC - 9PM E / 8PM C / 6PM P

0100	0115	Italy, RAI Intl	9675na	11800na		
0100	0115	Pakistan, Radio	11655as	15455as		
0100	0125	Netherlands, Radio	6165na	9845na		
0100	0127	Czech Rep, Radio Prague Intl	6200na	7345na		
0100	0127	Iran, VOIRI	6015na	6120na	9580am	
0100	0127	Vietnam, Voice of	6175na			
0100	0130	Australia, Radio	17775as			
0100	0130	s	Germnay, Universal Life	9435as		
0100	0130		Hungary, Radio Budapest	9835na		
0100	0130	as	Russia, Bible Voice BC	12035as		
0100	0130	mtwhfa	Serbia Montenegro, R Yugoslavia	7115eu		
0100	0130		Slovakia, R Slovakia Intl	5930am	9440am	
0100	0130		UAE, Gospel For Asia	6145as		
0100	0130	tw hfa	USA, Voice of America	5995am	6130am	7405am 9455am 9775am
			13710am			
0100	0130		Uzbekistan, Radio Tashkent	5955as	5975as	7135as 7215as
0100	0145		Germany, Deutsche Welle	6040am	6145am	9640am 9700na
			9765na			
0100	0156		China, China Radio Intl	9580na	9790na	
0100	0156		North Korea, Voice of	3560as	6195as	6520am 7140as 7580am
			9345as 11735am			
0100	0200		Anguilla, Caribbean Beacon	6090am		
0100	0200		Australia, ABC NT Katherine	5025do		
0100	0200		Australia, ABC NT Tennant Crk	4910do		
0100	0200		Australia, Radio	5995va	9475as	9580va 9660pa
			11650va 11660va	12080va	15240pa	15415as 17750as
			17580pa 17795va	21725va		
0100	0200	vi	Austria, AWR	9835as		
0100	0200		Canada, CBC Northern Service	9625do		
0100	0200		Canada, CFRX Toronto ON	6070do		
0100	0200		Canada, CFVP Calgary AB	6030do		
0100	0200		Canada, CKZN St John's NF	6160do		
0100	0200		Canada, CKZU Vancouver BC	6160do		
0100	0200		Costa Rica, R for Peace Intl	7445am	15040am	
0100	0200		Costa Rica, University Network	5030am	6150am	7375am 9725sa
			11870am 13750na			
0100	0200		Cuba, Radio Havana	6090na	9820na	11705usb
0100	0200		Ecuador, HCJB	9745na	21455usb	
0100	0200		Guyana, Voice of	3290do	5950do	
0100	0200		Indonesia, Voice of	9525va		
0100	0200		Japan, Radio	11860as	11880af	15325as 17685oc
			17810as 17835as	17845na		
0100	0200		Kyrgyz, Kyrgyz Radio	4010as	4795as	
0100	0200		Namibia, NBC	3270af	3290af	
0100	0200		New Zealand, Radio NZ Intl	17675pa		
0100	0200		Russia, University Network	9890as		
0100	0200		Singapore, SBC Radio One	6150do		
0100	0200	vi	Solomon Islands, SIBC	5020do	9545do	
0100	0200		Sri Lanka, SLBC	4940as	6005as	6075as 9770as
			15745as			
0100	0200		UK, BBC World Service	5975va	6195as	9410as 9525sa 9825am
			11955as 12095va	15280as	15310as	17790as
0100	0200		Ukraine, R Ukraine Intl	5905as	7375as	9610as
0100	0200		USA, Armed Forces Network	3903usb	4278usb	4319usb
			4993usb 6350usb	6458usb	10320usb	12579usb 12689usb
			13362usb			
0100	0200		USA, KAUJ Dallas TX	5755va		
0100	0200		USA, KTBN Salt Lk City UT	7505na		
0100	0200		USA, KWHR Naalehu HI	17510as		
0100	0200		USA, Voice of America	7200va	9850va	11705va 11820va
			15250va 15300va	17740va	17820va	
0100	0200		USA, WBCQ Kennebunk, ME	7415na	9335na	11660na
0100	0200		USA, WEWN Birmingham AL	5825na		
0100	0200		USA, WHRA Greenbush ME	7580va		
0100	0200		USA, WHRI Noblesville IN	5745va	7315am	
0100	0200		USA, WINB Red Lion PA	12160am		
0100	0200		USA, WJIE Louisville KY	7490am	13595am	
0100	0200	sm	USA, WRMI Miami FL	9955am		
0100	0200	tw hfa	USA, WRMI Miami FL	7385na		
0100	0200		USA, WRNO New Orleans LA	7355am		
0100	0200	tw hfas	USA, WSHB Cypress Creek SC	9430na		
0100	0200		USA, WTJC Newport NC	9370na		
0100	0200	sm	USA, WWBS Macon GA	11900na		
0100	0200		USA, WWCN Nashville TN	3210na	5070na	5935na 7465na
0100	0200		USA, WWRB Manchester TN	5050na	5085na	6890na
0100	0200		USA, WYFR Okeechobee FL	6065na	9505na	15060as
0100	0200		Zambia, Christian Voice	4965do		
0110	0200	as	Australia, Radio	9660va	12080pa	17580pa 21725as

SELECTED PROGRAMMING BEGINS ON PAGE 55

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0130	0145	vi	Libya, Voice of Africa	15435ir	21695ir				
0130	0200		Australia, Voice International		17775as				
0130	0200		Iran, VOIRI	6120na	9580na				
0130	0200		Sweden, Radio		9495as				
0130	0200		UK, RTE Radio		6155na				
0130	0200	twfha	USA, Voice of America	5995am	6130am	7405am	9455am	9775am	
			13740am						
0138	0150		Croatia, Croatian Radio	9925sa					
0140	0200		Vatican City, Vatican Radio		7335as	9865as			

0200 UTC - 10PM E / 9PM C / 7PM P

0200	0210		Bangladesh, Bangla Betar	4882as					
0200	0227		Czech Rep, Radio Prague Intl	6200na	7345na				
0200	0227		Iran, VOIRI	6120na	9580na				
0200	0228		Hungary, Radio Budapest		9835na				
0200	0230	twfha	Argentina, RAE		11710am				
0200	0230		Serbia Montenegro, RYugoslavia		7130eu				
0200	0230	as/vl	Solomon Islands, SIBC	5020do	9545do				
0200	0245		Germany, Deutsche Welle		9765as	11965as	13605as		
0200	0256		North Korea, Voice of	4405as	9325as	11335as	11845as		
0200	0256		Romania, R Romania Intl		9550na	9625as	11740as		
			11830na	15370au					
0200	0257		Canada, Radio Canada Intl		15150as	17860as			
0200	0259		Canada, Radio Canada Intl		6040am	9755am	11725am		
0200	0300		Anguilla, Caribbean Beacon		6090am				
0200	0300		Australia, ABCNT Alice Springs		4810eu	9960eu			
0200	0300		Australia, ABCNT Katherine		5025do				
0200	0300		Australia, ABCNT Tennant Crk		4910do				
0200	0300		Australia, Radio	5995va	9475as	9580va	9660pa	11650va	
			12080va	15240pa	15415as	15515as	17580pa	17750as	21725va
0200	0300	as	Australia, Radio	9660va	12080pa	17580pa	21725as		
0200	0300		Canada, CBC Northern Service		9625do				
0200	0300		Canada, CFRX Toronto ON		6070do				
0200	0300		Canada, CFVP Calgary AB		6030do				
0200	0300		Canada, CKZN St John's NF		6160do				
0200	0300		Canada, CKZU Vancouver BC		6160do				
0200	0300		Costa Rica, R for Peace Intl		7445am	15040am			
0200	0300		Costa Rica, University Network		5030am	6150am	7375am	9725sa	
			11870am	13750na					
0200	0300		Cuba, Radio Havana	6090na	9820na	11705usb			
0200	0300		Ecuador, H.CJB	9745na	12040as	21455usb			
0200	0300		Egypt, Radio Cairo		9475am				
0200	0300		Guyana, Voice of	3290do	5950do				
0200	0300		Malaysia, Radio		7295do				
0200	0300		Myanmar, Radio		7185do				
0200	0300		Namibia, NBC		3270af	3290af			
0200	0300		New Zealand, Radio NZ Intl		17675pa				
0200	0300		Philippines, Radio Pilipinas		12015me	15120me	15270me		
0200	0300		Russia, University Network		9890as				
0200	0300		Russia, Voice of Russia	6155na	7180na	9765na	12020na		
			13665na	15445na					
0200	0300		Singapore, SBC Radio One		6150do				
0200	0300	mtwhf/vl	Solomon Islands, SIBC	5020do	9545do				
0200	0300		South Korea, R Korea Intl		9560va	11810va	15575va		
0200	0300		Sri Lanka, SLBC		6075as	6130do	9770as	15745as	
0200	0300		Taiwan, R Taipei Intl	5950na	9680na	11740na	15320as	15345as	
0200	0300		UK, BBC World Service	5975va	6005af	9410me	9525am	9770af	
			9825sa	11760na	11955as	12095va	15280as	15310as	
			15360as	17790as					
0200	0300		USA, Armed Forces Network		3903usb	4278usb	4319usb	4993usb	
			6350usb	6458usb	10320usb	12579usb	12689usb	13362usb	
0200	0300		USA, KAU Dallas TX		5755va				
0200	0300		USA, KJES Vado NM		7555na				
0200	0300		USA, KTBN Salt Lk City UT		7505na				
0200	0300		USA, KWHIR Naalehu HI		17510as				
0200	0300		USA, Voice of America	7200va	9850va	11705va	11820va	15250va	
			15300va	17740na	17820va				
0200	0300		USA, WBCQ Kennebunk, ME		7415na	9335na	11660na		
0200	0300		USA, WEWN Birmingham AL		5825na				
0200	0300		USA, WHRA Greenbush ME		7580va				
0200	0300		USA, WHRI Noblesville IN		5745va	7315am			
0200	0300		USA, WINB Red Lion PA	9320am					
0200	0300		USA, WJIE Louisville KY	7490am					
0200	0300	sm	USA, WRMI Miami FL	9955am					
0200	0300	twfha	USA, WRMI Miami FL	7385na					
0200	0300		USA, WRNO New Orleans LA		7355am				
0200	0300	s	USA, WSHB Cypress Creek SC		9430na				
0200	0300	h	USA, WSHB Cypress Creek SC		7535am				
0200	0300		USA, WTJC Newport NC	9370na					
0200	0300		USA, WVCN Nashville TN		3210na	5070na	5935na	7465na	
0200	0300		USA, WWRB Manchester TN		5050na	5085na	6890na		
0200	0300		USA, WYFR Okeechobee FL		6065na	9505na			

0200	0300		Zambia, Christian Voice	4965do					
0200	1215		Cambodia, National Radio Of		11940as				
0205	0222		Croatia, Croatian Radio	7285na					
0215	0220		Nepal, Radio		3230as	5005as	6100as	7164as	
0230	0257		Vietnam, Voice of		6175na				
0230	0300		Iraq, Radio Iraq Intl		9687irg	11787eu			
0230	0300		Sweden, Radio		9495na				
0245	0300	twfha	Albania, Radio Tirana Intl		6115na	7160eu			
0250	0300		Vatican City, Vatican Radio		7305am	9605am			

0300 UTC - 11PM E / 10PM C / 8PM P

0300	0310		Vatican City, Vatican Radio		7305am	9605am	9660af		
0300	0330		Australia, Radio	9580va					
0300	0330	sm w f a	Belarus, Radio Belarus Intl		5970eu	7210eu			
0300	0330		Egypt, Radio Cairo		9475am				
0300	0330		South Africa, Channel Africa			9525af			
0300	0330		Thailand, Radio		15460na				
0300	0330	a	UK, Wales Radio Intl		9835na				
0300	0330		USA, KJES Vado NM		7555na				
0300	0345		Germany, Deutsche Welle		6020na	6045na	9640am	9700na	
			11985na						
0300	0356		China, China Radio Intl	9560na					
0300	0356		North Korea, Voice of	3560as	6195as	7140as	9345as		
0300	0400		Anguilla, Caribbean Beacon		6090am				
0300	0400		Australia, ABCNT Alice Springs		4810eu	9960eu			
0300	0400		Australia, ABCNT Katherine		5025do				
0300	0400		Australia, ABCNT Tennant Crk		4910do				
0300	0400		Australia, Radio	5995va	9500pa	9660pa	9815pa	11650va	
			12080va	15240pa	15415as	15515va	17580pa	17750as	21725va
0300	0400	as	Australia, Radio	9660va	12080pa	17580pa	21725as		
0300	0400	vi	Botswana, Radio	3356do	4820do	7255do			
0300	0400		Bulgaria, Radio		7400na	9400na			
0300	0400		Canada, CBC Northern Service		9625do				
0300	0400		Canada, CFRX Toronto ON		6070do				
0300	0400		Canada, CFVP Calgary AB		6030do				
0300	0400		Canada, CKZN St John's NF		6160do				
0300	0400		Canada, CKZU Vancouver BC		6160do				
0300	0400		Costa Rica, R for Peace Intl		7455am	15040am			
0300	0400		Costa Rica, University Network		5030am	6150am	7375am	9725sa	
			11870am	13750na					
0300	0400		Cuba, Radio Havana	6090na	9820na	11705usb			
0300	0400		Ecuador, H.CJB	9745na	12040as	21455usb			
0300	0400	vi	Guatemala, Radio Cultural		5955do				
0300	0400		Guyana, Voice of	3290do	5950do				
0300	0400		Japan, Radio		17825ca	21610ac			
0300	0400		Malaysia, Radio		7295do				
0300	0400		Namibia, NBC		3270af	3290af			
0300	0400		New Zealand, Radio NZ Intl		17675pa				
0300	0400		Oman, Radio		15355af				
0300	0400		Russia, University Network		9890as				
0300	0400		Russia, Voice of Russia	6155na	7180na	12020na	13665na		
			15445na						
0300	0400		Singapore, SBC Radio One		6150do				
0300	0400	mtwhf/vl	Solomon Islands, SIBC	5020do	9545do				
0300	0400		Sri Lanka, SLBC		6075as	6130do	9770as	15745as	
0300	0400		Taiwan, R Taipei Intl	5950na	9680na	11875as	15320as		
0300	0400		Uganda, Radio		4976do	5026do	7196do		
0300	0400		UK, BBC World Service	3255af	5975va	6005af	6190af	6195eu	
			7160af	9410va	9525am	11760va	11765af	12035af	12095as
			15280as	15310as	15360as	15575va	17640as	17760as	17790as
0300	0400		USA, Armed Forces Network		3903usb	4278usb	4319usb	4993usb	
			6350usb	6458usb	10320usb	12579usb	12689usb	13362usb	
0300	0400		USA, KAU Dallas TX		5755va				
0300	0400		USA, KTBN Salt Lk City UT		7505na				
0300	0400		USA, KWHIR Naalehu HI		17510as				
0300	0400		USA, Voice of America	4960af	6035af	6080af	7265af	7290af	
			7340af	7415af	9575af	9885af			
0300	0400		USA, WBCQ Kennebunk, ME		7415na	9335na	11660na		
0300	0400		USA, WEWN Birmingham AL		5825na				
0300	0400		USA, WHRA Greenbush ME		7580va				
0300	0400		USA, WHRI Noblesville IN		5745va	7315am			
0300	0400		USA, WINB Red Lion PA	9320am					
0300	0400		USA, WJIE Louisville KY	7490am					
0300	0400		USA, WRMI Miami FL	9955am					
0300	0400		USA, WRNO New Orleans LA		7395am				
0300	0400		USA, WTJC Newport NC	9370na					
0300	0400		USA, WVCN Nashville TN		3210na	5070na	5935na	7465na	
0300	0400		USA, WWRB Manchester TN		5050na	5085na	6890na		
0300	0400		USA, WYFR Okeechobee FL		5985na	6065na	9505na		
			11855na						
0300	0400		Zambia, Christian Voice	6065do					

Shortwave Guide



0310	0330		Vatican City, Vatican Radio	9660af		
0330	0345	vi	Libya, Voice of Africa	15435irr	21695irr	
0330	0350		UAE, Emirates Radio	12005na	13675na	15395na
0330	0357		Vietnam, Voice of	6175na		
0330	0358		Hungary, Radio Budapest	9835na		
0330	0400	twhfa	Albania, Radio Tirana Intl	6115na	7160eu	
0330	0400		Malaysia, RTM Kota Kinabalu	5979db		
0330	0400		Nigeria, Radio/Kaduna	4770db		
0330	0400		Nigeria, Radio/Lagos	3326db	4990al	
0330	0400		Sweden, Radio	9495na		
0330	0400		UK, BBC World Service	15420af		
0338	0350		Croatia, Croatian Radio	7285na		
0345	0400	shf	Seychelles, FEBA Radio	11885af		
0345	0400		Tajikistan, Radio	7245as		

0400 UTC - 12AM E / 11PM C / 9PM P

0400	0425		Belgium, Radio Vlaanderen Intl	11985na		
0400	0427		Czech Rep, Radio Prague Intl	7345na	7385na	9435na
0400	0430	mtwhf	France Radio France Intl	11995af		
0400	0430	vi	Guatemala, Radio Cultural	5955db		
0400	0430	stwhfa	Mexico, Radio Mexico Intl	9705am	11770am	
0400	0430		South Africa, AWR	9650af		
0400	0430		South Africa, Channel Africa	5955af		
0400	0430		Sri Lanka, SLBC	6005as	6130db	9770as 15745as
0400	0445		Germany, Deutsche Welle	6180af	7195af	9565af 9710af
			15410af			
0400	0445		USA, WYFR Okeechobee FL	6065na	9505na	9985eu 11530eu
0400	0450		Turkey, Voice of	6020va	7240va	
0400	0456		China, China Radio Intl	9730na		
0400	0456		Romania, R Romania Intl	9550na	11830na	15335as 17735as
0400	0500		Anguilla, Caribbean Beacon	6090am		
0400	0500		Australia, ABC NT Alice Springs	4810eu	9960eu	
0400	0500		Australia, ABC NT Katherine	5025db		
0400	0500		Australia, ABC NT Tennant Crk	4910db		
0400	0500		Australia, Radio	5995va	6080pa	7240pa 9500as 9660pa
			9815pa 11650va 12080va	15240pa	15415as	15515va
			17580pa 21725va			
0400	0500	as	Australia, Radio	9660va	12080pa	17580pa 21725as
0400	0500	vi	Botswana, Radio	3356db	4820db	7255db
0400	0500		Canada, CBC Northern Service	9625db		
0400	0500		Canada, CFRX Toronto ON	6070db		
0400	0500		Canada, CKZN St John's NF	6160db		
0400	0500		Canada, CKZU Vancouver BC	6160db		
0400	0500		Costa Rica, R for Peace Intl	7455am	15040am	
0400	0500		Costa Rica, University Network	5030am	6150am	7375am 9725sa
			11870am 13750na 17645as			
0400	0500		Cuba, Radio Havana	6090na	9820na	11705usb
0400	0500		Ecuador, HCJB	9745na	21455usb	
0400	0500		Guyana, Voice of	3290db	5950db	
0400	0500		Malaysia, Radio	7295db		
0400	0500		Malaysia, RTM Kota Kinabalu	5979db		
0400	0500		Namibia, NBC	3270af		
0400	0500		New Zealand, Radio NZ Intl	17675pa		
0400	0500		Nigeria, Radio/Kaduna	4770db	6090db	
0400	0500		Nigeria, Radio/Lagos	3326db	4990al	
0400	0500		Russia, University Network	17765as		
0400	0500		Russia, Voice of Russia	7125na	7180na	12020na 13665na
			15445na 15595na 17595na			
0400	0500	mtwhfa	Russia, Voice of Russia	12010na		
0400	0500		Singapore, SBC Radio One	6150db		
0400	0500	mtwhf/vl	Solomon Islands, SIBC	5020db	9545db	
0400	0500		Uganda, Radio	4976db	5026db	7196db
0400	0500		UK, BBC World Service	3255af	5975af	6005am 6135af 6190eu
			6195af 7160va 9410am	9525va	11760af	11765af 12035as
			12095as 15280as 15310as	15360af	15420va	15575as 17640as
			17760as 17790as 21660as			
0400	0500		Ukraine, R Ukraine Intl	7285as	7375as	7420as
0400	0500		USA, Armed Forces Network	6350usb	6458usb	10320usb 12579usb 12689usb 13362usb
			USA, KAU Dallas TX	5755va		
0400	0500		USA, KTBH Salt Lk City UT	7505na		
0400	0500		USA, KWHIR Naalehu HI	17780as		
0400	0500		USA, Voice of America	4960af	6080af	7170va 7290af 9525af
			9775af 9885af 15205af			
0400	0500		USA, WBCCQ Kennebunk, ME	7415na	9335na	11660na
0400	0500		USA, WEWN Birmingham AL	5825na		
0400	0500		USA, WHRA Greenbush ME	7580va		
0400	0500		USA, WHRI Noblesville IN	5745va	7315am	
0400	0500		USA, WJIE Louisville KY	7490am	13595am	
0400	0500		USA, WMLK Bethel PA	9465eu	9955eu	
0400	0500		USA, WRMI Miami FL	7385na		
0400	0500		USA, WRNO New Orleans LA	7395am		

0400	0500	tha	USA, WSHB Cypress Creek SC	12020af		
0400	0500		USA, WTJC Newport NC	9370na		
0400	0500		USA, WWCN Nashville TN	3210na	5070na	5935na 7465na
0400	0500		USA, WWRB Manchester TN	5950na	5085na	6890na
0400	0500		Zambia, Christian Voice	6065db		
0404	0500		USA, WYFR Okeechobee FL	9715na		
0405	0412		Croatia, Croatian Radio	7285na		
0427	0500	smt a	Madagascar, Radio VO Hope	12060af	15320af	
0430	0457		Czech Rep, Radio Prague Intl	9865va	11600va	
0430	0500		Australia, Radio	17750as		
0430	0500		Netherlands, Radio	6165na	9590na	
0430	0500		Nigeria, Radio/Enugu	6025db		
0430	0500		Nigeria, Radio/Ibadan	6050db		
0430	0500		South Africa, AWR	12080af		
0430	0500		Sri Lanka, SLBC	6130db		
0430	0500		Swaziland, TWR	4775af	6120af	
0430	0500		UAE, AWR	15160as		
0445	0500		Italy, RAI Intl	5965af	6100af	7235af
0455	0800	a	Monaco, TWR	9870eu		

0500 UTC - 1AM E / 12AM C / 10PM P

0500	0505		New Zealand, Radio NZ Intl	17675pa		
0500	0515		Israel, Kol Israel	9435va	11605va	17600va
0500	0530		Australia, Radio	9500as		
0500	0530	mtwhf	France Radio France Intl	13610af	15155af	
0500	0530	stwhfa	Mexico, Radio Mexico Intl	9705am	11770am	
0500	0530		Netherlands, Radio	6165na	9590na	
0500	0530		South Africa, AWR	6015af		
0500	0530		South Africa, Channel Africa	11710af		
0500	0530		UK, BBC World Service	15280as		
0500	0530		Vatican City, Vatican Radio	9660af	11625af	15570af
0500	0545		Germany, Deutsche Welle	5960na	6120na	9670na
			11795na			
0500	0556		China, China Radio Intl	9560na		
0500	0600		Anguilla, Caribbean Beacon	6090am		
0500	0600		Australia, ABC NT Alice Springs	4810eu	9960eu	
0500	0600		Australia, ABC NT Katherine	5025db		
0500	0600		Australia, ABC NT Tennant Crk	4910db		
0500	0600		Australia, Radio	5995va	6080pa	7240pa 9660pa 9815pa
			11880va 12080va 15240pa	15415as	15515va	17580pa 21725va
0500	0600	as	Australia, Radio	9660va	12080pa	17580pa 21725as
0500	0600	mtwhf	Bhutan, Bhutan BC Service	5030al	6035db	
0500	0600	vi	Botswana, Radio	3356db	4820db	7255db
0500	0600		Canada, CBC Northern Service	9625db		
0500	0600		Canada, CFRX Toronto ON	6070db		
0500	0600		Canada, CKZN St John's NF	6160db		
0500	0600		Canada, CKZU Vancouver BC	6160db		
0500	0600		Costa Rica, R for Peace Intl	7455am	15040am	
0500	0600		Costa Rica, University Network	5030am	6150am	7375am 9725sa
			11870am 13750na 17645as			
0500	0600		Cuba, Radio Havana	6195am	9550na	9820usb 9830na
0500	0600		Ecuador, HCJB	9745na	21455usb	
0500	0600		Guyana, Voice of	3290db	5950db	
0500	0600		Japan, Radio	5975as	6110na	7230eu 9835eu 15195as
			13630na 15195as	17810as	21755oc	
0500	0600		Kuwait, Radio	15110as		
0500	0600		Malaysia, Radio	7295db		
0500	0600		Malaysia, RTM Kota Kinabalu	5979db		
0500	0600		Namibia, NBC	6060af	6175af	
0500	0600		Nigeria, Radio/Enugu	6025db		
0500	0600		Nigeria, Radio/Ibadan	6050db		
0500	0600		Nigeria, Radio/Kaduna	4770db	6090db	9570db
0500	0600		Nigeria, Radio/Lagos	3326db	4990al	
0500	0600		Nigeria, Voice of	7255af	15120af	
0500	0600		Russia, University Network	17765as		
0500	0600	mtwhf	Russia, Voice of Russia	12010na	7180na	12020na 13665na
0500	0600		Russia, Voice of Russia	15445na 15595na		
0500	0600		Singapore, SBC Radio One	6150db		
0500	0600	vi	Solomon Islands, SIBC	5020db	9545db	
0500	0600		Swaziland, TWR	6120af	7205af	9500af
0500	0600		Uganda, Radio	4976db	5026db	7196db
0500	0600		UK, BBC World Service	6005af	6135am	6190af 6195eu 7160af
			9410va 11760va 11765af	11940af	11955as	15310as 15360as
			15420af 15565va 15575va	17640af	17760as	17790as 17885af
			21660as			
0500	0600		USA, Armed Forces Network	6350usb	6458usb	10320usb 12579usb 12689usb 13362usb
0500	0600		USA, KAU Dallas TX	5755va		
0500	0600		USA, KTBH Salt Lk City UT	7505na		
0500	0600		USA, KWHIR Naalehu HI	17780as		
0500	0600		USA, Voice of America	6035af	6080af	7170va 7295af 9700va

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0500	0600		11825va	11835af	13710af	15205va			
0500	0600	twhta	USA, WBCC Kennebunk, ME			7415na			
0500	0600		USA, WBCC Kennebunk, ME			9335na			
0500	0600		USA, WEWN Birmingham AL			5825na			
0500	0600		USA, WHRA Greenbush ME			7580va			
0500	0600		USA, WHRI Noblesville IN			5745va	7315am		
0500	0600		USA, WJIE Louisville KY	7490am		13595am			
0500	0600		USA, WMLK Bethel PA	9465eu		9955eu			
0500	0600		USA, WRMI Miami FL	7385na					
0500	0600		USA, WRNO New Orleans LA		7395am				
0500	0600	twhtas	USA, WSHB Cypress Creek SC		12020af				
0500	0600		USA, WTJC Newport NC	9370na					
0500	0600		USA, WWCN Nashville TN		3210na	5070na	5935na	7560na	
0500	0600		USA, WWRB Manchester TN		5950na	5085na	6890na		
0500	0600		USA, WYFR Okeechobee FL		5810na				
0500	0600		Zambia, Christian Voice	6065do					
0506	0600		New Zealand, Radio NZ Intl		15340pa				
0525	0600	vi	Ghana, Ghana BC Corp		3366do	4915do			
0530	0550		UAE, Emirates Radio	15435au	17830au	21695au			
0530	0600		Australia, Radio	17750as					
0530	0600		South Africa, AWR	15345af					
0530	0600		Thailand, Radio	13780eu					
0538	0550		Croatia, Croatian Radio	7285na					

0600 UTC - 2AM E / 1AM C / 11PM P

0600	0615		South Africa, TWR	11640af					
0600	0620	mtwhf	Vatican City, Vatican Radio		4005af	5890eu	7250eu		
0600	0630		France Radio France Intl	11710af	15155af				
0600	0630		South Africa, Channel Africa		15215af				
0600	0645		Germany, Deutsche Welle		7225af	9565af	11785af		
0600	0700		Anguilla, Caribbean Beacon		6090am				
0600	0700		Australia, ABC NT Alice Springs		4810eu	9960eu			
0600	0700		Australia, ABC NT Katherine		5025do				
0600	0700		Australia, ABC NT Tennant Crk		4910do				
0600	0700		Australia, Radio	7240va	9660pa	9815pa	11880va	12080va	
0600	0700			13620as	15320as	15240pa	15415as	15515va	17580pa
0600	0700			21725va					
0600	0700	as	Australia, Radio	9660va	12080pa	17580pa	21725as		
0600	0700		Canada, CFRX Toronto ON		6070do				
0600	0700		Canada, CFVP Calgary AB		6030do				
0600	0700		Canada, CKZN St John's NF		6160do				
0600	0700		Canada, CKZU Vancouver BC		6160do				
0600	0700		Costa Rica, R for Peace Intl		7455am	15040am			
0600	0700		Costa Rica, University Network		5030am	6150am	7375am	9725sa	
0600	0700			11870am	13750na	17645as			
0600	0700		Cuba, Radio Havana	6195am	9820na	9830usb			
0600	0700		Germany, Deutsche Welle		6140eu				
0600	0700	vi	Ghana, Ghana BC Corp		3366do	4915do			
0600	0700		Greece, Voice of	9420eu	15630eu				
0600	0700		Guyana, Voice of	3290do	5950do				
0600	0700		Japan, Radio	7230eu	9835na	11715va	11760va	11740as	
0600	0700			15195as	17870pa	21755oc			
0600	0700		Kuwait, Radio	15110as					
0600	0700		Liberia, ELWA	4760do					
0600	0700		Liberia, R Liberia Intl	6100do					
0600	0700		Malaysia, Radio	7295do					
0600	0700		Malaysia, Voice of	6175as	9750as	15295as			
0600	0700		Namibia, NBC	3270af	3290af				
0600	0700		New Zealand, Radio NZ Intl		15340pa				
0600	0700		Nigeria, Radio/Enugu	6025do					
0600	0700		Nigeria, Radio/Ibadan	6050do					
0600	0700		Nigeria, Radio/Kaduna	4770do	6090do	9570do			
0600	0700		Nigeria, Radio/Lagos	3326do	4990al				
0600	0700		Nigeria, Voice of	7255af	15120af				
0600	0700		Russia, University Network		17765as				
0600	0700		Russia, Voice of Russia	15275au	17665au	21790au			
0600	0700		Singapore, SBC Radio One		6150do				
0600	0700	vi	Solomon Islands, SIBC	5020do	9545do				
0600	0700		Swaziland, TWR	6120af	7205af	9500af			
0600	0700		Uganda, Radio	4976do	5026do	7196do			
0600	0700		UK, BBC World Service	6055af	6190af	6195eu	7160af	9410va	
0600	0700			11765af	11940af	11955as	12095va	15310as	15360as
0600	0700			15575va	17640af	17760as	17885af	21660as	21660as
0600	0700		USA, Armed Forces Network		3903usb	4278usb	4319usb	4993usb	
0600	0700			6350usb	6458usb	10320usb	12579usb	12689usb	13362usb
0600	0700		USA, KAU Dallas TX	5755va					
0600	0700		USA, KTVN Salt Lk City UT		7505na				
0600	0700		USA, KWHN Naalehu HI	17780as					
0600	0700		USA, Voice of America	5995va	6035af	6080af	6105af	7170af	
0600	0700			7295va	11825af	11930af	11995va	13710af	15205af
0600	0700		USA, WBCC Kennebunk, ME		7415na				
0600	0700		USA, WEWN Birmingham AL		5825na				

0600	0700		USA, WHRA Greenbush ME		7580va				
0600	0700		USA, WHRI Noblesville IN		5745va	7315am			
0600	0700		USA, WJIE Louisville KY	7490am	13595am				
0600	0700		USA, WMLK Bethel PA	9465eu	9955eu				
0600	0700		USA, WRMI Miami FL	7385na					
0600	0700		USA, WRNO New Orleans LA		7395am				
0600	0700	wfa	USA, WSHB Cypress Creek SC		7535af				
0600	0700		USA, WTJC Newport NC	9370na					
0600	0700		USA, WWCN Nashville TN		3210na	5070na	5935na	7560na	
0600	0700		USA, WYFR Okeechobee FL		7355eu	11530eu			
0600	0700	vi	Vanuatu, Radio	3945al					
0600	0700		Yemen, Rep of Yemen Radio		9780me				
0600	0700		Zambia, Christian Voice	9865do					
0603	0654		Romania, R Romania Intl		7105na	9510na	9570na		
0605	0612			11790na	11940na				
0630	0700		Croatia, Croatian Radio	9470pa					
0630	0700		Georgia, Georgian Radio		11805eu				
0630	0700	mtwhf/vi	Italy, IRRS	13840va					
0630	0700		Vatican City, Vatican Radio		11625af	13765af	15570af		
0637	0700		Romania, R Romania Intl		9510eu	9530na	9570eu	9625eu	
				11790eu	11829na	11940eu			

0700 UTC - 3AM E / 2AM C / 12AM P

0700	0705		New Zealand, Radio NZ Intl		15340pa				
0700	0730	mtwhf/vi	Italy, IRRS	13840va					
0700	0730		Slovakia, R Slovakia Intl	13715au	15460au	17550au			
0700	0730		UK, BBC World Service	6005af					
0700	0745		USA, WYFR Okeechobee FL		7355eu				
0700	0756		Romania, R Romania Intl		17720af	21480af			
0700	0800		Anguilla, Caribbean Beacon		6090am				
0700	0800		Australia, ABC NT Alice Springs		4810eu	9960eu			
0700	0800		Australia, ABC NT Katherine		5025do				
0700	0800		Australia, ABC NT Tennant Crk		4910do				
0700	0800		Australia, Radio	7240va	9660pa	9815pa	11880va	13620as	15320as
0700	0800			15320as	15420va	15415as	17580pa	17715va	17750as
0700	0800			21740va					
0700	0800		Canada, CFRX Toronto ON		6070do				
0700	0800		Canada, CFVP Calgary AB		6030do				
0700	0800		Canada, CKZN St John's NF		6160do				
0700	0800		Canada, CKZU Vancouver BC		6160do				
0700	0800		Costa Rica, R for Peace Intl		7455am	15040am			
0700	0800		Costa Rica, University Network		5030am	6150am	7375am	9725sa	
0700	0800			11870am	13750na	17645as			
0700	0800	mtwhf	Ecuador, HCJB	5965eu	11755pa	21455usb			
0700	0800	as/vi	Eqt Guinea, Radio Africa		15185af				
0700	0800	mtwhf	Eqt. Guinea, Radio East Africa		15185af				
0700	0800		France Radio France Intl	15605af					
0700	0800		Germany, Deutsche Welle		6140eu				
0700	0800	vi	Ghana, Ghana BC Corp		3366do	4915do			
0700	0800		Guyana, Voice of	3290do	5950do				
0700	0800		Kuwait, Radio	15110as					
0700	0800		Liberia, ELWA	4760do					
0700	0800		Liberia, R Liberia Intl	6100do					
0700	0800		Malaysia, Radio	7295do					
0700	0800		Malaysia, RTM Kota Kinabalu		5979do				
0700	0800		Malaysia, Voice of	6175as	9750as	15295as			
0700	0800		Myanmar, Radio	9730do					
0700	0800		Papua New Guinea, NBC		4890do	9675al			
0700	0800		Russia, University Network		17765as				
0700	0800		Russia, Voice of Russia	11820eu	12010eu	15275au	17665au		
0700	0800			21790au					
0700	0800	vi	Singapore, SBC Radio One		6150do				
0700	0800		Solomon Islands, SIBC	5020do	9545do				
0700	0800		Taiwan, R Taipei Intl	5950na					
0700	0800		UK, BBC World Service	6190af	6195eu	9410eu	11760va	11765af	
0700	0800			11940af	11955as	12095va	15310as	15360as	15400af
0700	0800			15565va	15575va	17640me	17760as	17885af	21660as
0700	0800		USA, Armed Forces Network		3903usb	4278usb	4319usb	4993usb	
0700	0800			6350usb	6458usb	10320usb	12579usb	12689usb	13362usb
0700	0800		USA, KAU Dallas TX	5755va					
0700	0800		USA, KTVN Salt Lk City UT		7505na				
0700	0800		USA, KWHN Naalehu HI	11565pa	17780as				
0700	0800		USA, WBCC Kennebunk, ME		7415na				
0700	0800		USA, WEWN Birmingham AL		5825na				
0700	0800		USA, WHRA Greenbush ME		7580va				
0700	0800		USA, WHRI Noblesville IN		5745va	7315am			
0700	0800		USA, WJIE Louisville KY	7490am	13595am				
0700	0800		USA, WMLK Bethel PA	9465eu	9955eu				
0700	0800		USA, WRNO New Orleans LA		7395am				
0700	0800	tf	USA, WSHB Cypress Creek SC		7535af				
0700	0800		USA, WTJC Newport NC	9370na					

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0700	0800		USA, WYFR Okeechobee FL	9985af	11580af		
0700	0800	vi	Vanuatu, Radio	3945af	4960do		
0706	0800		New Zealand, Radio NZ Intl	11675pa			
0715	0745	mtwhf	Guam, TWR/KTWR	15215as			
0730	0745	vi/mtwhf	Vatican City, Vatican Radio	4005eu	5980eu	6185eu	7250eu
			9645af	11740eu	15595as		
0730	0800		Australia, Radio	11695as			
0730	0800	vi	Austria, AWR	17820va			
0730	0800		Bulgaria, Radio	12000eu	13600eu		
0730	0800		Switzerland, Swiss R Intl	9885af	13790af	17665af	
0730	0800	as	UK, BBC World Service	15575va			
0738	0750		Croatia, Croatian Radio	9470pa			
0745	0800	as	Albania, TWR	12070eu			
0745	0800	mtwhf	Guam, TWR/KTWR	15215as	15330as		
0755	0800	mtwhf	Albania, TWR	12070eu			
0755	0800	mtwhf	Monaco, TWR	9870eu			

0800 UTC - 4AM E / 3AM C / 1AM P

0800	0804		Pakistan, Radio	17835eu	21465eu		
0800	0820	s	Monaco, TWR	9870eu			
0800	0825		Belgium, Radio Vlaanderen Intl	5985eu			
0800	0827		Czech Rep, Radio Prague Intl	11600eu	15255eu		
0800	0830		Australia, ABCNT Alice Springs	4810eu	9960eu		
0800	0830		Australia, ABCNT Katherine	5025do			
0800	0830		Australia, ABCNT Tennant Crk	4910do			
0800	0830		Malaysia, RTM Kota Kinabalu	5979do			
0800	0830		Malaysia, Voice of	6175as	9750as	15295as	
0800	0830		Myanmar, Radio	9730do			
0800	0845	mtwhf	Germany, Bible Voice	5975	wu		
0800	0845		USA, WYFR Okeechobee FL	11580af			
0800	0850	as	Albania, TWR	12070eu			
0800	0850	s	Monaco, TWR	9870eu			
0800	0900	mtwhf	Albania, TWR	12070eu			
0800	0900		Anguilla, Caribbean Beacon	6090am			
0800	0900		Australia, Radio	5995pa	7240va	9580va	9660pa 9710pa
			11880va 12080va 15420va	15415as	17715va	17750as	17795va
			21725as 21740va				
0800	0900	vi	Austria, AWR	9660af	17820va		
0800	0900	mtwhf	Bhutan, Bhutan BC Service	5030al	6035do		
0800	0900		Canada, CFRX Toronto ON	6070do			
0800	0900		Canada, CFVP Calgary AB	6030do			
0800	0900		Canada, CKZN St John's NF	6160do			
0800	0900		Canada, CKZU Vancouver BC	6160do			
0800	0900		Costa Rica, R for Peace Intl	7455am	15040am		
0800	0900		Costa Rica, University Network	5030am	6150am	7375am	9725sa
			11870am 13750na 17645as				
0800	0900		Ecuador, HCJB	5965eu	11755pa	21455usb	
0800	0900	mtwhf	Egt Guinea, Radio Africa	15185af			
0800	0900	as/vi	Egt. Guinea, Radio East Africa	15185af			
0800	0900		Germany, Deutsche Welle	6140eu			
0800	0900	as	Guam, TWR/KTWR	15330as			
0800	0900	mtwhf	Guam, TWR/KTWR	15215as			
0800	0900		Guyana, Voice of	3290do	5950do		
0800	0900		Indonesia, Voice of	9525va			
0800	0900		Liberia, ELWA	4760do			
0800	0900		Liberia, R Liberia Intl	6100do			
0800	0900		Malaysia, Radio	7295do			
0800	0900		New Zealand, Radio NZ Intl	11675pa			
0800	0900		Papua New Guinea, NBC	4890do	9675al		
0800	0900	as	Russia, Bible Voice BC	5975eu			
0800	0900		Russia, University Network	17765as			
0800	0900		Russia, Voice of Russia	11820eu	12010eu	17495au	17525au
			17665au				
0800	0900		Singapore, SBC Radio One	6150do			
0800	0900	a	South Africa, Radio League	9750af	21560af		
0800	0900		South Korea, R Korea Intl	9570va	13670va		
0800	0900		UK, BBC World Service	6190af	6195eu	11760va	11940af
			11955as 12095va 15310as	15360as	15400af	15485va	15565va
			15575va 17640va 17760as	17830af	17885af	21470af	21660as
			21830as				
0800	0900		USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb
			6350usb 6458usb 10320usb	12579usb	12689usb	13362usb	
0800	0900		USA, KAU Dallas TX	5755va			
0800	0900		USA, KNLS Anchor Point AK	11765as			
0800	0900		USA, KTBN Salt Lk City UT	7505na			
0800	0900		USA, KWHRN Naalehu HI	11565pa			
0800	0900		USA, Voice of America	11955va	13605va	15150va	
0800	0900		USA, WBCQ Kennebunk, ME	7415na			
0800	0900		USA, WEWN Birmingham AL	5825na			
0800	0900		USA, WHRI Noblesville IN	5745va	7315am		
0800	0900		USA, WJIE Louisville KY	7490am			
0800	0900		USA, WMLK Bethel PA	9465eu	9955eu		

0800	0900		USA, WRM Miami FL	7385na			
0800	0900		USA, WRNO New Orleans LA	7395am			
0800	0900	as	USA, WSHB Cypress Creek SC	7535eu	9845oc		
0800	0900	tw	USA, WSHB Cypress Creek SC	9845oc			
0800	0900		USA, WTJC Newport NC	9370na			
0800	0900		USA, WWCR Nashville TN	3210na	5070na	5935na	7560na
0800	0900	vi	Vanuatu, Radio	3945af	4960do		
0805	0812		Croatia, Croatian Radio	13820au			
0830	0840	s	Armenia, Voice of	4810eu	15270as		
0830	0900		Australia, ABCNT Alice Springs	2310do	4835irr		
0830	0900		Australia, ABCNT Katherine	2485do			
0830	0900		Australia, ABCNT Tennant Crk	2325do			
0830	0900		Georgia, Georgian Radio	11910eu			
0830	0900	vi	Solomon Islands, SIBC	5020do	9545do		
0830	0900		Switzerland, Swiss R Intl	21770af			
0840	0850		Turkmenistan, Turkmen Radio	4930as			

0900 UTC - 5AM E / 4AM C / 2AM P

0900	0915	as	Russia, Bible Voice BC	5975eu			
0900	0920	mtwhf s	Albania, TWR	12070eu			
0900	0920	mtwhf	Monaco, TWR	9870eu			
0900	0930		Austria, AWR	17670af			
0900	0930		Guam, TWR/KTWR	15330as			
0900	0945		Germany, Deutsche Welle	6160oc	9510va	9770as	11785af
			15410af 17820va 17845va	17860as	21560af		
0900	0956		China, China Radio Intl	11730pa	15210pa		
0900	1000		Anguilla, Caribbean Beacon	6090am			
0900	1000		Australia, ABCNT Alice Springs	2310do	4835irr		
0900	1000		Australia, ABCNT Katherine	2485do			
0900	1000		Australia, ABCNT Tennant Crk	2325do			
0900	1000		Australia, Radio	11880as	17775as		
0900	1000		Australia, Voice International	13685as			
0900	1000		Canada, CFRX Toronto ON	6070do			
0900	1000		Canada, CFVP Calgary AB	6030do			
0900	1000		Canada, CKZN St John's NF	6160do			
0900	1000		Canada, CKZU Vancouver BC	6160do			
0900	1000		Costa Rica, R for Peace Intl	7455am	15040am		
0900	1000		Costa Rica, University Network	5030am	6150am	7375am	9725sa
			11870am 13750na 17645as				
0900	1000		Ecuador, HCJB	11755pa	21455usb		
0900	1000		Germany, Deutsche Welle	11965eu			
0900	1000		Guyana, Voice of	3290do	5950do		
0900	1000	as/vi	Italy, IRRS	13840va			
0900	1000		Liberia, R Liberia Intl	6100do			
0900	1000		Malaysia, Radio	7295do			
0900	1000	vi/s	Malta, VO Mediterranean	9630eu			
0900	1000		New Zealand, Radio NZ Intl	11675pa			
0900	1000		Palau, KHBV/VO Hope	15725as			
0900	1000		Papua New Guinea, NBC	4890do	9675al		
0900	1000		Russia, University Network	17765as			
0900	1000		Russia, Voice of Russia	11820eu	15275au	17495au	17525au
			17665au				
0900	1000		Singapore, SBC Radio One	6150do			
0900	1000		UK, BBC World Service	6190af	6195va	9605as	9740as 11760va
			11940af 12095eu 15190as	15310as	15360as	15400af	15485va
			15565va 15575va 17640va	17760as	17830af	17790as	17885af
			21470af 21660as				
0900	1000		USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb
			6350usb 6458usb 10320usb	12579usb	12689usb	13362usb	
0900	1000		USA, KAU Dallas TX	5755va			
0900	1000		USA, KTBN Salt Lk City UT	7505na			
0900	1000		USA, KWHRN Naalehu HI	11565pa			
0900	1000		USA, Voice of America	11955va	13610va	15150va	
0900	1000		USA, WBCQ Kennebunk, ME	7415na			
0900	1000		USA, WEWN Birmingham AL	5825na			
0900	1000		USA, WHRA Greenbush ME	7580va			
0900	1000		USA, WHRI Noblesville IN	5745va	7315am		
0900	1000		USA, WJIE Louisville KY	7490am			
0900	1000		USA, WRM Miami FL	7385na			
0900	1000	th	USA, WSHB Cypress Creek SC	7535eu			
0900	1000		USA, WTJC Newport NC	9370na			
0900	1000		USA, WWCR Nashville TN	3210na	5070na	5935na	7560na
0900	1000	vi	Vanuatu, Radio	3945af	4960do		
0930	1000		Georgia, Georgian Radio	11910me			
0930	1000		Lithuania, R Vilnius	9710eu			
0930	1000		Netherlands, Radio	9790va	12065va	13710as	
0938	0950		Croatia, Croatian Radio	13820au			

Shortwave Guide



1000 UTC - 6AM E / 5AM C / 3AM P

1000	1027	Vietnam, Voice of	9840as	12020au			
1000	1029	Czech Rep, Radio Prague Intl		21745va			
1000	1030	Guam, AWR/KSDA	11705as	11900as			
1000	1030	Mongolia, Voice of	12085as				
1000	1030	Sri Lanka, SLBC	4940as				
1000	1030	UK, BBC World Service	9605as	15360as	21660as		
1000	1030	UK, RTE Radio	15280au				
1000	1045	USA, KWHIR Naalehu HI	11565pa				
1000	1056	China, China Radio Intl	11730pa	15210pa			
1000	1056	North Korea, Voice of	3560as	9335am	9849as	11710am	11735as
1000	1100	Anguilla, Caribbean Beacon		6090am			
1000	1100	Australia, ABCNT Alice Springs		2310do	4835irr		
1000	1100	Australia, ABCNT Katherine		2485do			
1000	1100	Australia, ABCNT Tennant Crk		2325do			
1000	1100	Australia, Radio	9580va	9660pa	11880as	15240as	15415as
1000	1100		17580pa 17750as 17795va	21725va	21820as		
1000	1100	Australia, Voice International		13685as			
1000	1100	as Bhutan, Bhutan BC Service		5030al	6035do		
1000	1100	Canada, CFRX Toronto ON		6070do			
1000	1100	Canada, CFVP Calgary AB		6030do			
1000	1100	Canada, CKZN St John's NF		6160do			
1000	1100	Canada, CKZU Vancouver BC		6160do			
1000	1100	Costa Rica, R for Peace Intl		7455am	15040am		
1000	1100	Costa Rica, University Network		5030am	6150am	7375am	9725sa
1000	1100		11870am 13750na 17645as				
1000	1100	Ecuador, HCJB		11755pa	21455usb		
1000	1100	Germany, Deutsche Welle		6140eu			
1000	1100	Guyana, Voice of	3290do	5950do			
1000	1100	India, All India Radio	13710as	15020as	15235as	15260as	
1000	1100	as/vl	17510au 17800as 17895au				
1000	1100	Italy, IRRS	13840va				
1000	1100	Japan, Radio	9695as	15590as	21755oc		
1000	1100	Liberia, R Liberia Intl		6100do			
1000	1100	Malaysia, Radio	7295do				
1000	1100	Netherlands, Radio	9790va	12065va	13710as		
1000	1100	New Zealand, Radio NZ Intl		11675pa			
1000	1100	Palau, KHBN/VO Hope	15725as				
1000	1100	Papua New Guinea, NBC		4890do	9675al		
1000	1100	Russia, University Network		17765as			
1000	1100	Singapore, SBC Radio One		6150do			
1000	1100	South Africa, Radio Veritas		7240af			
1000	1100	UK, BBC World Service	6190af	6195va	9740as	11760va	11940af
1000	1100		12095eu 15190as 15310as	15485va	15565va	15575va	17640va
1000	1100		17760as 17790as 17885af	21470af			
1000	1100	as UK, BBC World Service	15400af	17830af			
1000	1100	USA, Armed Forces Network		3903usb	4278usb	4319usb	4993usb
1000	1100		6350usb 6458usb 10320usb	12579usb	12689usb	13362usb	
1000	1100	USA, KAU Dallas TX	5755va				
1000	1100	USA, KTBN Salt Lk City UT		7505na			
1000	1100	USA, KWHIR Naalehu HI	9930as				
1000	1100	USA, Voice of America	5745am	5985va	7370am	9590am	11720va
1000	1100		15250va 15425va 15455va				
1000	1100	USA, WBQC Kennebunk, ME		7415na			
1000	1100	USA, WVEWN Birmingham AL		5825na	15745na		
1000	1100	USA, WHRI Noblesville IN		9495va	9840am		
1000	1100	USA, WJIE Louisville KY	7490am	13595am			
1000	1100	USA, WRMI Miami FL	9955am				
1000	1100	USA, WRNO New Orleans LA		7395am			
1000	1100	USA, WSHB Cypress Creek SC		6095am	11780am		
1000	1100	USA, WSHB Cypress Creek SC		11780as			
1000	1100	USA, WTJC Newport NC	9370na				
1000	1100	USA, WWCR Nashville TN		5070na	5935na	7560na	9475na
1000	1100	USA, WYFR Okeechobee FL		5950na			
1000	1100	Vatican City, Vatican Radio		5890eu			
1000	1200	s USA, WSHB Cypress Creek SC		9455am	11780as		
1030	1045	mtwhf Ethiopia, Radio	5990do	7110do	9704do		
1030	1100	Guam, AWR/KSDA	11900as				
1030	1100	Iran, VOIRI	15215as	15480as	21470as	21730as	
1030	1100	Netherlands, Radio		6045eu	9860eu		
1030	1100	Sri Lanka, SLBC	4940as	11835as	15120as	17850as	
1030	1100	UAE, Emirates Radio	13675eu	15370eu	15395eu	21605eu	

1100 UTC - 7AM E / 6AM C / 4AM P

1100	1104	Pakistan, Radio	17835eu	21465eu			
1100	1105	New Zealand, Radio NZ Intl		11675pa			
1100	1127	Iran, VOIRI	15215as	15375as	21470as	21730as	
1100	1127	Vietnam, Voice of	7285as				
1100	1130	as Bhutan, Bhutan BC Service		5030al	6035do		
1100	1130	Netherlands, Radio	9790va	12065va	13710as		

1100	1130	UK, BBC World Service	15400af	17790sa			
1100	1145	Germany, Deutsche Welle	25700af	15410af	17800af	21530af	21780af
1100	1200	Anguilla, Caribbean Beacon		11775am			
1100	1200	Australia, ABCNT Alice Springs		2310do	4835irr		
1100	1200	Australia, ABCNT Katherine		2485do			
1100	1200	Australia, ABCNT Tennant Crk		2325do			
1100	1200	Australia, Radio	5995pa	6020pa	9475as	9580va	9660pa
1100	1200		11650va 11880as 12080va	15240va	15415as	17580pa	17750as
1100	1200		17795va 21725va 21820as				
1100	1200	Australia, Voice International		13685as			
1100	1200	Canada, CFRX Toronto ON		6070do			
1100	1200	Canada, CFVP Calgary AB		6030do			
1100	1200	Canada, CKZN St John's NF		6160do			
1100	1200	Canada, CKZU Vancouver BC		6160do			
1100	1200	Costa Rica, R for Peace Intl		7455am	15040am		
1100	1200	Costa Rica, University Network		5030am	6150am	7375am	9725sa
1100	1200		11870am 13750na 17645as				
1100	1200	Ecuador, HCJB		12005am	15115am	21455usb	
1100	1200	Germany, Deutsche Welle		6140eu			
1100	1200	as/vl Italy, IRRS	13840va				
1100	1200	Japan, Radio	6120na	9695as	15590as		
1100	1200	Jordan, Radio	11690eu				
1100	1200	Malaysia, Radio	7295do				
1100	1200	Netherlands, Radio	5965na	6045eu	9860eu		
1100	1200	Papua New Guinea, NBC		4890do	9675al		
1100	1200	Russia, University Network		17765as			
1100	1200	Singapore, R Singapore Intl		6150as	9600as		
1100	1200	Taiwan, R Taipei Intl	7445as				
1100	1200	UK, BBC World Service	6190af	6195va	7160as	9740va	11760af
1100	1200		11940eu 12095va 15190as	15310va	15485va	15565va	15575va
1100	1200		17640as 17760as 17790af	17830af	17885af	21470af	
1100	1200	USA, Armed Forces Network		3903usb	4278usb	4319usb	4993usb
1100	1200		6350usb 6458usb 10320usb	12579usb	12689usb	13362usb	
1100	1200	USA, KAU Dallas TX	5755va				
1100	1200	USA, KTBN Salt Lk City UT		7505na			
1100	1200	USA, KWHIR Naalehu HI	9930as	11565pa			
1100	1200	USA, Voice of America	5985va	6110va	9760va	11705va	11720va
1100	1200		15250va 15425va 15455va				
1100	1200	USA, WVEWN Birmingham AL		5825na	15745na		
1100	1200	USA, WHRI Noblesville IN		9495va	9840am		
1100	1200	USA, WINB Red Lion PA	13570am				
1100	1200	USA, WJIE Louisville KY	7490am	13595am			
1100	1200	USA, WRMI Miami FL	9955am				
1100	1200	USA, WRNO New Orleans LA		7395am			
1100	1200	USA, WSHB Cypress Creek SC		6095am			
1100	1200	USA, WTJC Newport NC	9370na				
1100	1200	USA, WWCR Nashville TN		5070na	5935na	7560na	
1100	1200	USA, WYFR Okeechobee FL		5950na			
1106	1200	New Zealand, Radio NZ Intl		15175pa			
1115	1130	Israel, Kol Israel	15640va	17545va			
1115	1145	Nepal, Radio	3230as	5005as	6100as	7164as	
1130	1145	vi Libya, Voice of Africa	15435irr	21695irr			
1130	1155	Belgium, Radio Vlaanderen Intl		7390as			
1130	1157	Czech Rep, Radio Prague Intl		11640va	21745va		
1130	1200	South Korea, R Korea Intl		9650na			
1130	1200	Sri Lanka, SLBC	4940as				
1130	1200	a UK, Wales Radio Intl	17625au				
1130	1200	f Vatican City, Vatican Radio		5595va	17515va		

1200 UTC - 8AM E / 7AM C / 5AM P

1200	1225	Netherlands, Radio	5965na	6045eu	9860eu		
1200	1230	France Radio France Intl	15540af	25820af			
1200	1230	Uzbekistan, Radio Tashkent		5060as	5975as	6025as	9715as
1200	1245	USA, WYFR Okeechobee FL		5950na			
1200	1256	China, China Radio Intl	9730as	9760pa	11760pa	11855as	11980as
1200	1256		15415pa				
1200	1256	Romania, R Romania Intl		17790eu			
1200	1259	Canada, Radio Canada Intl		9660as	11730as		
1200	1300	Anguilla, Caribbean Beacon		11775am			
1200	1300	Australia, ABCNT Katherine		2485do			
1200	1300	Australia, ABCNT Tennant Crk		2325do			
1200	1300	Australia, Radio	5995pa	6020pa	9475as	9580va	9660pa
1200	1300		11650va 11880as 12080va	15415as	15240pa	17580pa	21725va
1200	1300		21820as				
1200	1300	Australia, Voice International		13685as			
1200	1300	Canada, CBC Northern Service		9625do			
1200	1300	Canada, CFRX Toronto ON		6070do			
1200	1300	Canada, CFVP Calgary AB		6030do			
1200	1300	Canada, CKZN St John's NF		6160do			
1200	1300	Canada, CKZU Vancouver BC		6160do			

Shortwave Guide

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1200	1300	China, Voice of Hope	7485as				
1200	1300	Costa Rica, R for Peace Intl	7455am	15040am			
1200	1300	Costa Rica, University Network	5030am	6150am	7375am	9725sa	
		11870am 13750na	17645as				
1200	1300	Ecuador, HCJB	12005am	15115am	21455usb		
1200	1300	Germany, Deutsche Welle	6140eu				
1200	1300	Germany, Overcomer Ministries	5975eu				
1200	1300	Italy, IRRS	13840va				
1200	1300	Jordan, Radio	11690eu				
1200	1300	Malaysia, Radio	7295do				
1200	1300	New Zealand, Radio NZ Intl	15175pa				
1200	1300	Papua New Guinea, NBC	4890do	9675al			
1200	1300	Russia, University Network	17765as				
1200	1300	Russia, Voice of Hope	13590as				
1200	1300	Singapore, R Singapore Intl	6150as	9600as			
1200	1300	Taiwan, R Taipei Intl	7130as	9610au			
1200	1300	UK, BBC World Service	6190af	6195va	7160as	9740va	11760af
		11940eu 12095va 15190as	15310va	15485va	15565va	15575va	
		17640as 17760as 17790af	17830af	17885af	21470af		
1200	1300	Ukraine, R Ukraine Intl	11825na	11840na	13590na	17760na	
1200	1300	USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb	
		6350usb 6458usb 10320usb	12579usb	12689usb	13362usb		
1200	1300	USA, KAU Dallas TX	5755va				
1200	1300	USA, KTBN Salt Lk City UT	7505na				
1200	1300	USA, KWHN Naalehu HI	9930as	11565pa			
1200	1300	USA, Voice of America	6110va	9645va	9760va	11705va	11715va
		15250va 15425va 15455va					
1200	1300	USA, WEWN Birmingham AL	5825na	15745na			
1200	1300	USA, WHRI Noblesville IN	9495na	9840am			
1200	1300	USA, WINB Red Lion PA	13570am				
1200	1300	USA, WJIE Louisville KY	7490am	13595am			
1200	1300	USA, WRMI Miami FL	9955am				
1200	1300	USA, WRNO New Orleans LA	7395am				
1200	1300	USA, WSHB Cypress Creek SC	6095am	9880as			
1200	1300	USA, WSHB Cypress Creek SC	9455am	9880as			
1200	1300	USA, WSHB Cypress Creek SC	9880as				
1200	1300	USA, WTJC Newport NC	9370na				
1200	1300	USA, WWCR Nashville TN	5070na	5935na	7560na		
		15825na					
1200	1300	USA, WYFR Okeechobee FL	11970na	13695na			
1215	1300	Egypt, Radio Cairo	17775as				
1230	1257	Vietnam, Voice of	9840as	12020as			
1230	1300	Australia, Radio	17750as				
1230	1300	Bangladesh, Bangla Betar	7185as	9550as			
1230	1300	Bulgaria, Radio	12000eu	15700eu			
1230	1300	Sri Lanka, SLBC	4940as	6005as	6075as	9770as	15745as
1230	1300	Sweden, Radio	17505va	18960na			
1230	1300	Thailand, Radio	9810va				
1230	1300	UAE, Gospel For Asia	15170as				
1245	1300	Seychelles, FEBA Radio	15535me				

1300 UTC - 9AM E / 8AM C / 6AM P

1300	1305	New Zealand, Radio NZ Intl	15175pa				
1300	1310	Turkmenistan, Turkmen Radio	5015as				
1300	1330	Australia, Radio	11880as				
1300	1330	Egypt, Radio Cairo	17775as				
1300	1330	UAE, AWR	17870as				
1300	1330	UAE, Gospel For Asia	15170as				
1300	1345	USA, WYFR Okeechobee FL	11970na				
1300	1356	China, China Radio Intl	9570na	11760pa	11900pa	11980as	15180as
1300	1356	North Korea, Voice of	4405as	7505eu	9335na	11335eu	
		11710am 13760eu					
1300	1400	Anguilla, Caribbean Beacon	11775am				
1300	1400	Australia, Radio	5995pa	6020pa	9580va	9660pa	11650va
		12080va 15240pa 15415as	17580pa	21725va	21820as		
1300	1400	Australia, Voice International	13690as				
1300	1400	Canada, CBC Northern Service	9625do				
1300	1400	Canada, CFRX Toronto ON	6070do				
1300	1400	Canada, CFVP Calgary AB	6030do				
1300	1400	Canada, CKZN St John's NF	6160do				
1300	1400	Canada, CKZU Vancouver BC	6160do				
1300	1400	Canada, Radio Canada Intl	9515am	13655am	17710am		
1300	1400	China, Voice of Hope	7485as				
1300	1400	Costa Rica, R for Peace Intl	15040am				
1300	1400	Costa Rica, University Network	5030am	6150am	7375am	9725sa	
		11870am 13750na 17645as					
1300	1400	Ecuador, HCJB	12005am	15115am	21455usb		
1300	1400	Germany, Deutsche Welle	6140eu				
1300	1400	Germany, Overcomer Ministries	13810me				
1300	1400	Italy, IRRS	13840va				
1300	1400	Jordan, Radio	11690eu				
1300	1400	Malaysia, Radio	7295do				

1300	1400	Poland, Radio Polonia	6095eu	9525eu			
1300	1400	Russia, University Network	17765as				
1300	1400	Singapore, R Singapore Intl	6150as	9600as			
1300	1400	South Africa, Channel Africa	11720af	17725af	21760af		
1300	1400	South Korea, R Korea Intl	9570as	13670as			
1300	1400	UK, BBC World Service	6190af	6195va	7160as	9740va	11760af
		11940eu 12095va 15190as	15310va	15485va	15565va	15575va	
		17640as 17760as 17790af	17830af	17885af	21470af		
1300	1400	USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb	
		6350usb 6458usb 10320usb	12579usb	12689usb	13362usb		
1300	1400	USA, KAU Dallas TX	5755va				
1300	1400	USA, KNLS Anchor Point AK	11765as				
1300	1400	USA, KTBN Salt Lk City UT	7505na				
1300	1400	USA, KWHN Naalehu HI	9930as	11565pa			
1300	1400	USA, Voice of America	6160va	9645va	9760va	11705va	15425va
		15480va					
1300	1400	USA, WBCQ Kennebunk, ME	7415na				
1300	1400	USA, WBCQ Kennebunk, ME	17494na				
1300	1400	USA, WEWN Birmingham AL	9955na	15745na			
1300	1400	USA, WHRA Greenbush ME	17560va				
1300	1400	USA, WHRI Noblesville IN	9840am	15105va			
1300	1400	USA, WINB Red Lion PA	13570am				
1300	1400	USA, WJIE Louisville KY	7490am	13595am			
1300	1400	USA, WRMI Miami FL	15725na				
1300	1400	USA, WRNO New Orleans LA	7395am				
1300	1400	USA, WSHB Cypress Creek SC	9430na	7460as			
1300	1400	USA, WSHB Cypress Creek SC	9455am	7460as			
1300	1400	USA, WSHB Cypress Creek SC	7460as				
1300	1400	USA, WTJC Newport NC	9370na				
1300	1400	USA, WWCR Nashville TN	5935na	7560na	12160na		
		15825na					
1300	1400	USA, WYFR Okeechobee FL	11740na	11830na	11560as	17510as	
		17675na					
1306	1400	New Zealand, Radio NZ Intl	6095pa				
1330	1350	UAE, Emirates Radio	13630eu	13675eu	15400eu	21605eu	
1330	1357	Vietnam, Voice of	7145eu	9730eu			
1330	1400	Australia, Radio	11660as	17750as			
1330	1400	Germany, Voice of Hope	15775as				
1330	1400	Guam, AWR/KSDA	11755as	15660as			
1330	1400	India, All India Radio	9690as	11620as	13710as		
1330	1400	Laos, Lao National Radio	7145as				
1330	1400	Serbia Montenegro, R Yugoslavia	11835au				
1330	1400	Sweden, Radio	9490va	18960na			
1330	1400	Turkey, Voice of	17690va	17815eu			
1330	1400	UAE, AWR	15385as				
1330	1400	Uzbekistan, Radio Tashkent	5060as	5975as	6025as	9715as	

1400 UTC - 10AM E / 9AM C / 7AM P

1400	1420	Turkey, Voice of	17690va	17815va			
1400	1429	Czech Rep, Radio Prague Intl	21745va				
1400	1430	Ecuador, HCJB	12005am	15115am	21455usb		
1400	1430	Germany, Voice of Hope	15775as				
1400	1430	Thailand, Radio	9530va				
1400	1455	South Africa, Channel Africa	11720af	17725af	21760af		
1400	1456	China, China Radio Intl	7405na	9700as	11765as	13685af	
		15125af 17720na					
1400	1456	Romania, R Romania Intl	15365eu	17790eu			
1400	1500	Anguilla, Caribbean Beacon	11775am				
1400	1500	Australia, Radio	9580va	9660pa	11650va	11660as	12080va
		15240pa 15415as 15515va	17580pa	17750as	21725va		
1400	1500	Australia, Voice International	13690as				
1400	1500	Canada, CBC Northern Service	9625do				
1400	1500	Canada, CFRX Toronto ON	6070do				
1400	1500	Canada, CFVP Calgary AB	6030do				
1400	1500	Canada, CKZN St John's NF	6160do				
1400	1500	Canada, CKZU Vancouver BC	6160do				
1400	1500	Canada, Radio Canada Intl	9515am	13655am	17710am		
1400	1500	Costa Rica, R for Peace Intl	15040am				
1400	1500	Costa Rica, University Network	5030am	6150am	7375am	9725sa	
		11870am 13750na 17645as					
1400	1500	France Radio France Intl	7175af	9580af	17620af		
1400	1500	Germany, Deutsche Welle	6140eu				
1400	1500	Germany, Overcomer Ministries	13810me				
1400	1500	India, All India Radio	9690as	11620as	13710as		
1400	1500	Japan, Radio	7200as	9505na	9845as	11730as	
1400	1500	Jordan, Radio	11690eu				
1400	1500	New Zealand, Radio NZ Intl	6095pa				
1400	1500	Oman, Radio	15140eu				
1400	1500	Russia, University Network	17765as				
1400	1500	Singapore, SBC Radio One	6150do				
1400	1500	Taiwan, R Taipei Intl	15265as				
1400	1500	UAE, AWR	15385as				

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1400	1500		UK, BBC World Service 15190am 15310as 21470af 21660af	6190af 15485va	6195va 15565va	9740as 15575va	11940af 17640va	12095va 17830af
1400	1500		USA, Armed Forces Network 6350usb 6458usb 10320usb		3903usb 12579usb	4278usb 12689usb	4319usb 13362usb	4993usb
1400	1500		USA, KAUJ Dallas TX	13815va				
1400	1500		USA, KJES Vado NM	11715na				
1400	1500		USA, KTBN Salt Lk City UT		7505na			
1400	1500		USA, KVHR Naalehu HI	9930as				
1400	1500		USA, Voice of America 15205va 15395va 15425va	6110va 15480va	7125va	9645va	9760va	11705va
1400	1500		USA, WBCQ Kennebunk, ME		17495na			
1400	1500		USA, WEVN Birmingham AL		9955na	15745na		
1400	1500		USA, WHRA Greenbush ME		17560va			
1400	1500		USA, WHRI Noblesville IN		9840am	15105va		
1400	1500		USA, WINB Red Lion PA	13570am				
1400	1500		USA, WJIE Louisville KY	7490am	13595am			
1400	1500		USA, WRMI Miami FL	15725na				
1400	1500		USA, WRNO New Orleans LA		7395am			
1400	1500		USA, WTJC Newport NC	9370na				
1400	1500		USA, WWCN Nashville TN 15825na		9475na	12160na	13845na	
1400	1500		USA, WYFR Okeechobee FL 17675na 17760na		11740na	11830na	11560as	17510sa
1415	1420		Nepal, Radio	3230as	5005as	6100as	7164as	
1430	1450	vl	Vatican City, Vatican Radio		9865as	13765as	15235as	
1430	1500		Australia, Radio	9475as				
1430	1500		Myanmar, Radio	5040do	5985do			
1430	1500		Netherlands, Radio	9890as	11835as	12075as	15220na	
1430	1500		Sweden, Radio	17505va	18960na			
1445	1500		Guam, TWR/KTWR	15330ns				

1500 UTC - 11AM E / 10AM C / 8AM P

1500	1515	whf	Seychelles, FEBA Radio	15445as				
1500	1530		Mexico, Radio Mexico Intl		9705am	11770am		
1500	1530		Mongolia, Voice of	12015eu				
1500	1530		South Africa, Channel Africa		17725af			
1500	1530	as	UK, BBC World Service	11860af	21490af			
1500	1545		Guam, TWR/KTWR	15330as				
1500	1556		China, China Radio Intl	7405as	7160as	9785as	13685af	
			15125na 17720na					
1500	1556		North Korea, Voice of	4405as	7505eu	9335am	11335eu	
			11710am					
1500	1557		Canada, Radio Canada Intl	15360as	17870as			
1500	1559	mtwhf	Canada, Radio Canada Intl	9515am	13655am	17710am		
1500	1600		Anguilla, Caribbean Beacon	11775am				
1500	1600		Australia, Radio	9475as	9580va	9660pa	11650va	11660as
			12080va 15240pa 15415as	15515va	17580pa	17750as	21725va	
1500	1600		Australia, Voice International	13690as				
1500	1600		Canada, CBC Northern Service	9625do				
1500	1600		Canada, CFRX Toronto ON	6070do				
1500	1600		Canada, CFVP Calgary AB	6030do				
1500	1600		Canada, CKZN St John's NF	6160do				
1500	1600		Canada, CKZU Vancouver BC	6160do				
1500	1600		Costa Rica, R for Peace Intl	15040am				
1500	1600		Costa Rica, University Network	5030am	6150am	7375am	9725sa	
			11870am 13750na 17645as					
1500	1600		Germany, Deutsche Welle	6140eu				
1500	1600	a	Germany, Overcomer Ministries	6110eu				
1500	1600		Japan, Radio	7200as	9750as	9845as	11730as	
1500	1600		Jordan, Radio	11690na				
1500	1600	s	Latvia, Laser Radio	5935eu				
1500	1600		Myanmar, Radio	5040do	5985do			
1500	1600		Netherlands, Radio	9890as	11835as	12075as	15220na	
1500	1600	occasional	New Zealand, Radio NZ Intl	6095pa				
1500	1600		Russia, Voice of Russia	6205as	7315as	7350as	9590as	9875as
			11500as					
1500	1600		Singapore, SBC Radio One	6150do				
1500	1600		UK, BBC World Service	5975as	6190af	6195va	9410va	9740as
			11940af 12095va 15190am	15310as	15400af	15485va	15565va	
			17640me 17790as 17830af	21470af	21660af			
1500	1600		USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb	
			6350usb 6458usb 10320usb	12579usb	12689usb	13362usb		
1500	1600		USA, KAU Dallas TX	13815va				
1500	1600		USA, KJES Vado NM	11715na				
1500	1600		USA, KTBN Salt Lk City UT	7505na				
1500	1600		USA, KWHR Naalehu HI	9930as				
1500	1600		USA, Voice of America	7125va	9575va	9645va	15205va	15395va
1500	1600		USA, WBCQ Kennebunk, ME	17495na				
1500	1600		USA, WEWN Birmingham AL	9955na	15745na			
1500	1600		USA, WHRA Greenbush ME	17650na				

1500	1600		USA, WHRI Noblesville IN	9840am	15105va		
1500	1600		USA, WINB Red Lion PA	13570am			
1500	1600		USA, WJIE Louisville KY	7490am	13595am		
1500	1600		USA, WRMI Miami FL	15725na			
1500	1600		USA, WRNO New Orleans LA	7395am			
1500	1600		USA, WTJC Newport NC	9370na			
1500	1600		USA, WWCR Nashville TN	9475na	12160na	13845na	
			15825na				
1500	1600		USA, WYFR Okeechobee FL	6280as	11830na	15520na	
			17760na				
1515	1530		Germany, Voice of Hope	9860me			
1515	1530	mtwhf	Seychelles, FEBA Radio	11600as			
1530	1545		Bangladesh, Bangla Betar	4882as	15520as		
1530	1545		Seychelles, FEBA Radio	11600as			
1530	1550	as	Vatican City, Vatican Radio	9865va	13765af	15235af	
1530	1600		Iran, VOIRI	7115as	7195su	9610as	11775as
1530	1600		USA, Voice of America	6110va	9760va	9795va	11995va
1540	1550		Turkmenistan, Turkmen Radio	4930as			15460va
1545	1600	s h	Bangladesh, Bangla Betar	4882as	15520as		
1545	1600	smt hfa	Seychelles, FEBA Radio	11600as			

1600 UTC - 12PM E / 11AM C / 9AM P

1600	1615		Pakistan, Radio	11570me	15070me	15530af	17725af
1600	1625		Netherlands, Radio	9890as	11835as	12075as	15220na
1600	1627		Vietnam, Voice of	7145eu	9730eu		
1600	1628	s	Hungary, Radio Budapest		6025eu	11680eu	
1600	1630		Guam, AWR/KSDA	11560as	15495as	17630as	
1600	1630		Mexico, Radio Mexico Intl		9705am	11770am	
1600	1630		South Africa, Channel Africa		9525af		
1600	1630		UAE, Gospel For Asia	9785as			
1600	1630		USA, KVHR Naalehu HI	9930as			
1600	1635		UAE, Emirates Radio	13630eu	13675eu	15400eu	21605eu
1600	1645		Germany, Deutsche Welle		11695am	15455af	21840af
1600	1645		USA, WYFR Keeshobee FL		17790na		
1600	1650	occasional	New Zealand, Radio NZ Intl		6095pa		
1600	1656		China, China Radio Intl 7190af		13650af		
1600	1656		North Korea, Voice of	3560as		11735af	
1600	1659	as	Canada, Radio Canada Intl		9515am	13655am	17710am
1600	1700		Algeria, Radio Algiers Intl		11715eu	15160eu	
1600	1700		Anguilla, Caribbean Beacon		11775am		
1600	1700		Australia, Radio	9475as	9580va	9660pa	11650va
			11880as 12080va 15240pa		15415as	15515va	17580pa
			Australia, Voice International		13690as		21725va
1600	1700		Canada, CBC Northern Service		9625do		
1600	1700		Canada, CFRX Toronto ON		6070do		
1600	1700		Canada, CFVP Calgary AB		6030do		
1600	1700		Canada, CKZN St John's NF		6160do		
1600	1700		Canada, CKZU Vancouver BC		6160do		
1600	1700		Costa Rica, R for Peace Intl		15040am		
1600	1700		Costa Rica, University Network		5030am	6150am	7375am
			11870am 13750na				9725sa
1600	1700		Ethiopia, Radio	5990do	7110af	7165af	9560af
			11800af				9704af
1600	1700		France Radio France Intl 11615af		11995af	12015af	15605af
1600	1700		Germany, Deutsche Welle		6140eu	6170as	7225as
1600	1700	a	Germany, Overcomer Ministries		6110eu		9735af
1600	1700		Jordan, Radio	11690na			
1600	1700	s	Latvia, Laser Radio	5935eu			
1600	1700		Russia, Voice of Russia	4940as	4965as	4975as	6005me
			9590as 9830me				7305as
1600	1700		South Africa, Radio Veritas		3230af		
1600	1700		South Korea, R Korea Intl		5975va	9515va	9870va
1600	1700		Sri Lanka, SLBC	4940as			
1600	1700		Taiwan, R Taipei Intl	11560as			
1600	1700		UK, BBC World Service	3915as	5975as	6190af	6195va
			9410va 9510as 9740as		11940af	12095va	7160as
			15400af 15565va 17640me		17790as	15190am	15310as
					17790as	21470af	21660af
1600	1700		USA, Armed Forces Network		3903usb	4278usb	4319usb
			6350usb 6458usb 10320usb		12579usb	12689usb	4993usb
1600	1700		USA, KAU Dallas TX	13815va			
1600	1700		USA, KJES Vado NM	11715na			
1600	1700		USA, KTVN Salt Lk City UT		15590na		
1600	1700		USA, Voice of America	6035af	6110va	7125va	9575va
			13600va 13710af 15395va		15205va	15420af	9645va
			17715af 17895af 17640va			15485af	15445va
1600	1700		USA, WBCQ Kennebunk, ME		17495na		
1600	1700		USA, WEWN Birmingham AL		13615na	15745na	
1600	1700		USA, WHRA Greenbush ME		17650va		
1600	1700		USA, WHRI Noblesville IN		13760na	15105va	
1600	1700		USA, WINB Red Lion PA	13570am			
1600	1700		USA, WJIE Louisville KY	7490am	13595am		
1600	1700		USA, WMLK Bethel PA	9465eu			

Shortwave Guide



1600	1700	USA, WRMI Miami FL	15725na			
1600	1700	USA, WRNO New Orleans LA	7395am			
1600	1700	USA, WSHB Cypress Creek SC	18910af			
1600	1700	USA, WTJC Newport NC	9370na			
1600	1700	USA, WWCN Nashville TN	9475na	12160na	13845na	
		15825na				
1600	1700	USA, WWRB Manchester TN	9320na	12172na		
1600	1700	USA, WYFR Okeechobee FL	6280as	11830na	15520na	
		17760na	18980eu	21455eu		
1600	1700	Zimbabwe, SWRAfrica	6145do			
1630	1700	Australia, Radio	17750as			
1630	1700	Austria, AWR	9850af			
1630	1700	Egypt, Radio Cairo	15255af			
1630	1700	Georgia, Georgian Radio	6180me			
1630	1700	Guam, AWR/KSDA	11560as	11980as	15495as	17630as
1630	1700	UAE, AWR	9890as			
1630	1700	as UK, BBC World Service	15420af	21490af		
1645	1700	Tajikistan, Radio	7245as			
1650	1700	mtwhf New Zealand, Radio NZ Intl	11980pa			

1700 UTC - 1PM E / 12PM C / 10AM P

1700	1727	Czech Rep, Radio Prague Intl	5930va	17485va		
1700	1730	France Radio France Intl	11615af	11995af	12015af	17850af
1700	1730	Jordan, Radio	11690na			
1700	1730	wha Russia, Bible Voice BC	7435me			
1700	1730	South Africa, Channel Africa	17870af			
1700	1730	mtwhf UK, BBC World Service	6005af	9630af	18950eu	
1700	1750	New Zealand, Radio NZ Intl	11980pa			
1700	1756	China, China Radio Intl	7150af	9570af	9695as	11910af
1700	1756	Romania, R Romania Intl	7155eu	9625eu	9690eu	11940eu
1700	1800	Anguilla, Caribbean Beacon	11775am			
1700	1800	Australia, Radio	9475as	9580va	9660pa	9815pa
		12080va	15240pa	15515va	17580pa	21725pa
1700	1800	Australia, Voice International	11685as			
1700	1800	Canada, CBC Northern Service	9625do			
1700	1800	Canada, CFRX Toronto ON	6070do			
1700	1800	Canada, CFVP Calgary AB	6030do			
1700	1800	Canada, CKZN St John's NF	6160do			
1700	1800	Canada, CKZU Vancouver BC	6160do			
1700	1800	Costa Rica, R for Peace Intl	15040am			
1700	1800	Costa Rica, University Network	5030am	6150am	7375am	9725sa
		11870am	13750na	17645as		
1700	1800	Egypt, Radio Cairo	15255af			
1700	1800	Germany, Deutsche Welle	6140eu			
1700	1800	a Germany, Overcomer Ministries	6110eu			
1700	1800	Germany, United Methodist Ch	11735va	13820va		
1700	1800	a Greece, Voice of	9420eu	15725eu	17705na	
1700	1800	Japan, Radio	9505na	11970na	15355af	
1700	1800	Russia, Voice of Russia	9470me	9590as	9830me	
1700	1800	South Africa, Radio Veritas	3230af			
1700	1800	Sri Lanka, SLBC	4940as			
1700	1800	Taiwan, R Taipei Intl	11550as			
1700	1800	UK, BBC World Service	3255af	3915as	5975as	6190af
		7160as	9410va	9510as	12095va	15310as
		15565va	17640me	17830af	21470af	15400af
1700	1800	USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb
		6350usb	6458usb	10320usb	12579usb	13362usb
1700	1800	USA, KAU Dallas TX	13815va			
1700	1800	USA, KTBN Salt Lk City UT	15590na			
1700	1800	USA, Voice of America	6040va	6110va	7125va	9645va
		13710af	15205va	15395va	15240af	15445af
1700	1800	mtwhf USA, Voice of America	5990va	6045va	9525va	9795va
		12005va	15255va			
1700	1800	USA, WBCQ Kennebunk, ME	17495na			
1700	1800	USA, WEWN Birmingham AL	13615na			
1700	1800	USA, WHRA Greenbush ME	17650va			
1700	1800	USA, WHRI Noblesville IN	13760na	15105va		
1700	1800	USA, WINB Red Lion PA	13570am			
1700	1800	USA, WJIE Louisville KY	7490am	13595am		
1700	1800	USA, WMLK Bethel PA	9465eu	15265eu		
1700	1800	USA, WRMI Miami FL	15725na			
1700	1800	USA, WRNO New Orleans LA	7395am			
1700	1800	USA, WSHB Cypress Creek SC	15190af			
1700	1800	USA, WTJC Newport NC	9370na			
1700	1800	USA, WWCN Nashville TN	9475na	12160na	13845na	
		15825na				
1700	1800	USA, WWRB Manchester TN	9320na	12172na		
1700	1800	USA, WYFR Okeechobee FL	18980eu	21455eu		
1700	1800	Zimbabwe, SWRAfrica	6145do			
1715	1730	mtwhf UK, BBC World Service	15390am			
1715	1730	Vatican City, Vatican Radio	4005eu	5890eu	7250eu	9645eu
		15595eu				

1725	1745	vi/mtwhf UK, United Nations Radio	7170af	15495af	17580eu	
1730	1745	Israel, Kol Israel	11605va	17545va		
1730	1745	vi Libya, Voice of Africa	15435irr	21695irr		
1730	1745	UK, BBC World Service	3390va	7230va	9525va	
1730	1800	Australia, Radio	17750as			
1730	1800	s Germany, Voice of Hope	9860me			
1730	1800	Guam, AWR/KSDA	9385me			
1730	1800	vi/mtwhf Malta, VO Mediterranean	9850eu			
1730	1800	Netherlands, Radio	6020af	7120af	11655af	
1730	1800	Philippines, Radio Pilipinas	11730me	11890me	15190me	
1730	1800	swhf Russia, Bible Voice BC	7435me			
1730	1800	Slovakia, RSlovakia Intl	5915eu	6055eu	7345eu	
1730	1800	Swaziland, TWR	3200af	9500af		
1730	1800	Switzerland, Swiss R Intl	9755va	13790af	15555va	
1730	1800	Vatican City, Vatican Radio	13765af	15570af	17515af	
1735	1745	vi/th Paraguay, Radio Nacional	9739sa			
1745	1800	Bangladesh, Bangla Betar	7185eu	9550eu	15520eu	
1745	1800	India, All India Radio	7410eu	9445af	9950eu	11620eu
		13605af	15155af	17670af		11925af
1751	1800	New Zealand, Radio NZ Intl	15265pa			

1800 UTC - 2PM E / 1PM C / 11AM P

1800	1815	Russia, Bible Voice BC	7435me			
1800	1815	as Russia, Bible Voice BC	5880eu			
1800	1827	Czech Rep, Radio Prague Intl	5930va	7315va		
1800	1827	Vietnam, Voice of	5955eu	7145eu	9730eu	
1800	1830	Azerbaijan, Voice of	6110eu	9155eu		
1800	1830	Egypt, Radio Cairo	15255af			
1800	1830	s Germany, Deutsche Welle	3995au			
1800	1830	Germany, Universal Life	11840af			
1800	1830	South Africa, Channel Africa	17870af			
1800	1830	UK, BBC World Service	5975as	9510as	15705as	
1800	1830	UK, RTE Radio	9895me			
1800	1900	Anguilla, Caribbean Beacon	11775am			
1800	1900	Australia, Radio	5995pa	6080pa	7240va	9475as
		9710pa	9815pa	11880va	12080va	15515va
		21725pa	21820as			17750as
1800	1900	Australia, Voice International	11685as			
1800	1900	Bangladesh, Bangla Betar	7185eu	9550eu	15520eu	
1800	1900	Canada, CBC Northern Service	9625do			
1800	1900	Canada, CFRX Toronto ON	6070do			
1800	1900	Canada, CFVP Calgary AB	6030do			
1800	1900	Canada, CKZN St John's NF	6160do			
1800	1900	Canada, CKZU Vancouver BC	6160do			
1800	1900	Costa Rica, R for Peace Intl	15040am			
1800	1900	Costa Rica, University Network	5030am	6150am	7375am	9725sa
		11870am	13750na	17645as		
1800	1900	Germany, Deutsche Welle	6140eu			
1800	1900	Germany, United Methodist Ch	11735va	13820va		
1800	1900	India, All India Radio	7410eu	9445af	9950eu	11620eu
		13605af	15155af	17670af		11925af
1800	1900	s Kuwait, Radio	11990as			
1800	1900	Latvia, Laser Radio	5935eu			
1800	1900	Liberia, ELWA	4760do			
1800	1900	Liberia, R Liberia Intl	5100do			
1800	1900	Netherlands, Radio	6020af	7120af	11655af	
1800	1900	New Zealand, Radio NZ Intl	15265pa			
1800	1900	Philippines, Radio Pilipinas	11730me	11890me	15190me	
1800	1900	Poland, Radio Polonia	5995eu	7285eu		
1800	1900	Russia, University Network	9890as			
1800	1900	Russia, Voice of Russia	7290eu	7335af	7340eu	9590as
		11510af				9830af
1800	1900	as Russia, Voice of Russia	5950eu	6175eu		
1800	1900	s South Africa, Radio League	3215af			
1800	1900	South Africa, Radio Veritas	3230af			
1800	1900	Sri Lanka, SLBC	4940as			
1800	1900	Swaziland, TWR	3200af	9500af		
1800	1900	Taiwan, R Taipei Intl	3955eu			
1800	1900	UK, BBC World Service	3255af	6190af	6195va	9410va
		12095me	15310va	15400af	15420af	15565me
		USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb
		6350usb	6458usb	10320usb	12579usb	13362usb
1800	1900	USA, KAU Dallas TX	13815va			
1800	1900	USA, KTBN Salt Lk City UT	15590na			
1800	1900	USA, Voice of America	6035af	6040va	9760va	9885va
		13710af	15240af	15580af	17895af	11975af
1800	1900	USA, WBCQ Kennebunk, ME	17495na			
1800	1900	USA, WEWN Birmingham AL	13615na			
1800	1900	USA, WHRA Greenbush ME	17650va			
1800	1900	USA, WHRI Noblesville IN	9495va	13760na		
1800	1900	USA, WINB Red Lion PA	13570am			
1800	1900	USA, WJIE Louisville KY	7490am	13595am		

Shortwave Guide



1800	1900		USA, WMLK Bethel PA	9465eu	15265eu		
1800	1900		USA, WRMI Miami FL	15725na			
1800	1900		USA, WRNO New Orleans LA	7395am			
1800	1900	w	USA, WSHB Cypress Creek SC	18910af			
1800	1900		USA, WTJC Newport NC	9370na			
1800	1900		USA, WWCN Nashville TN	9475na	12160na	13845na	
			15825na				
1800	1900		USA, WWRB Manchester TN	9320na	12172na		
1800	1900		USA, WYFR Okeechobee FL	18980eu			
1800	1900		Yemen, Rep of Yemen Radio	9780me			
1800	1900		Zimbabwe, SWR Africa	6145do			
1815	1845	as	Russia, Bible Voice BC	7435me			
1815	1900	as	Russia, Bible Voice BC	5880eu			
1830	1855		Belgium, Radio Vlaanderen Intl	7465as	13650eu	13685eu	
1830	1900		Bulgaria, Radio	5800eu	7500eu		
1830	1900		Georgia, Georgian Radio	11910eu			
1830	1900		South Africa, AWR	5960af	6095af	11985af	
1830	1900		South Africa, AWR	11985af			
1830	1900	mtwhfa	Sweden, Radio	6065va			
1830	1900	s	Sweden, Radio	5840va			
1830	1900		UK, BBC World Service	6005af	9630af		
1830	1900		UK, RTE Radio	13640na	21630af		
1830	1900	vi/mtwhf	UK, United Nations Radio	9850me	13775af		
1845	1900	s	Russia, Bible Voice BC	7435me			
1845	1900	a	Russia, Bible Voice BC	7435eu			

1900 UTC - 3PM E / 2PM C / 12PM P

1900	1927		Vietnam, Voice of	7145eu	9730eu		
1900	1930		Germany, Deutsche Welle	3995eu			
1900	1930	s	Germany, Universal Life	9470me			
1900	1930	s	Greece, Voice of	7475eu	9420eu	17705na	
1900	1930		Philippines, Radio Pilipinas	11730me	11890me	15190me	
1900	1930	f	Russia, Bible Voice BC	9470na			
1900	1930		UK, BBC World Service	13800eu			
1900	1945	mtwfh/vl	Germany, Bible Voice	6010eu			
1900	1945		Germany, Deutsche Welle	17810af	21780af		
			India, All India Radio	7410eu	9445af	11620eu	11925af
			15075af	15155af	17670af		
1900	1945		USA, WYFR Okeechobee FL	15115eu	18930eu		
1900	1956		China, China Radio Intl	9440af	9585af		
1900	1956		North Korea, Voice of	4405as	7505eu	11335eu	
1900	2000		Anguilla, Caribbean Beacon	11775am			
1900	2000	mtwhf	Argentina, RAE	11710eu			
1900	2000		Australia, Radio	6080pa	7240va	9475as	9500as
			9815pa	11880va	12080va	21820as	9580va
1900	2000		Australia, Voice International	13770as			
1900	2000	vi	Botswana, Radio	3356do	4820do	7255do	
1900	2000		Canada, CBC Northern Service	9625do			
1900	2000		Canada, CFRX Toronto ON	6070do			
1900	2000		Canada, CFVP Calgary AB	6030do			
1900	2000		Canada, CKZN St John's NF	6160do			
1900	2000		Canada, CKZU Vancouver BC	6160do			
1900	2000		Costa Rica, R for Peace Intl	15040am			
1900	2000		Costa Rica, University Network	5030am	6150am	7375am	9725sa
			11870am	13750na	17645as		
1900	2000	mtwhf	Eqt Guinea, Radio Africa	15185af			
1900	2000	vi	Ghana, Ghana BC Corp	3366do	4915do		
1900	2000		Kuwait, Radio	11990as			
1900	2000	s	Latvia, Laser Radio	5935eu			
1900	2000		Liberia, ELWA	4760do			
1900	2000		Liberia, R Liberia Intl	5100do			
1900	2000		Malaysia, Radio	7295do			
1900	2000		Namibia, NBC	3270af	3290af		
1900	2000		Netherlands, Radio	6020af	7120af	11655af	
1900	2000		New Zealand, Radio NZ Intl	15265pa			
1900	2000		Nigeria, Radio/Enugu	6025do			
1900	2000		Nigeria, Radio/Ibadan	6050do			
1900	2000		Nigeria, Radio/Kaduna	4770do	6090do	9570do	
1900	2000		Nigeria, Radio/Lagos	3326do	4990al		
1900	2000		Nigeria, Voice of	7255af	15120af		
1900	2000		Papua New Guinea, NBC	4890do	9675al		
1900	2000	a	Russia, Bible Voice BC	5880me			
1900	2000	s	Russia, Bible Voice BC	7435me			
1900	2000		Russia, University Network	9890as			
1900	2000		Russia, Voice of Russia	5950eu	6175eu	6235eu	7290eu
			7340eu	7360eu	7440af	11510af	7335af
			South Korea, R Korea Intl	5975va	7275va		
1900	2000		Sri Lanka, SLBC	4940as			
1900	2000	a	Sri Lanka, SLBC	6010eu			
1900	2000		Swaziland, TWR	3200af			

1900	2000		Thailand, Radio	9535eu			
1900	2000		Uganda, Radio	4976do	5026do	7196do	
1900	2000		UK, BBC World Service	3255af	6005af	6190af	6195va
			9630af	12095af	15310va	15400af	9410va
1900	2000		USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb
			6350usb	6458usb	10320usb	12579usb	12689usb
1900	2000		USA, KAU Dallas TX	13815va			
1900	2000		USA, KJES Vado NM	15385au			
1900	2000		USA, KTBN Salt Lk City UT	15590na			
1900	2000		USA, Voice of America	4950af	6035af	7415af	9525va
			9760va	9785va	11870va	11975af	9690va
			15240af	15180va	15580af	17895af	12015va
1900	2000		USA, Voice of America	5965va	9840va	11720va	11970va
			15410va				15205va
1900	2000		USA, WBCQ Kennebunk, ME	17495na			
1900	2000	s	USA, WBCQ Kennebunk, ME	7415na			
1900	2000	mtwhf	USA, WBCQ Kennebunk, ME	9335na			
1900	2000		USA, WEWN Birmingham AL	13615na			
1900	2000		USA, WHRA Greenbush ME	17650va			
1900	2000		USA, WHRI Noblesville IN	9495va	13760na		
1900	2000		USA, WINB Red Lion PA	13570am			
1900	2000		USA, WJIE Louisville KY	7490am	13595am		
1900	2000		USA, WMLK Bethel PA	9495eu	15265eu		
1900	2000		USA, WRMI Miami FL	15725na			
1900	2000		USA, WRNO New Orleans LA	7395am			
1900	2000	th	USA, WSHB Cypress Creek SC	15665eu	18910af		
1900	2000	mwfa	USA, WSHB Cypress Creek SC	18910af			
1900	2000		USA, WTJC Newport NC	9370na			
1900	2000		USA, WWCN Nashville TN	9475na	12160na	13845na	
			15825na				
1900	2000		USA, WWRB Manchester TN	9320na	12172na		
1900	2000		USA, WYFR Okeechobee FL	3230af			
1900	2000	vi	Vanuatu, Radio	3945al	7260do		
1900	2000		Zambia, Christian Voice	4965do			
1930	2000		Georgia, Georgian Radio	11760eu			
1930	2000		Greece, Voice of	7475eu			
1930	2000	s	Greece, Voice of	9420eu	17705na		
1930	2000		Iran, VOIRI	6110eu	7215eu	7320eu	11695af
1930	2000		Serbia Montenegro, R Yugoslavia	6100eu			15140af
1930	2000		Slovakia, R Slovakia Intl	5915eu	6055eu	7345eu	
1930	2000	mtwhf/vl	Solomon Islands, SIBC	5020do	9545do		
1930	2000		Switzerland, Swiss R Intl	9755va	13660va	15485va	17660va
1930	2000		Turkey, Voice of	9890eu			
1935	1955		Italy, RAI Intl	5970eu	9745eu		
1940	1945		Turkmenistan, Turkmen Radio	4930as			
1945	2000	mtwhfa	Albania, Radio Tirana Intl	7210na	9510na		

2000 UTC - 4PM E / 3PM C / 1PM P

2000	2015	s/vl	Solomon Islands, SIBC	5020do	9545do		
2000	2020		Turkey, Voice of	9890eu			
2000	2025		Netherlands, Radio	6020af	7120af	11655af	
2000	2027		Iran, VOIRI	6110eu	7215eu	7320eu	11695af
2000	2028		Hungary, Radio Budapest	6025eu	7135eu	7175eu	15140af
2000	2030		Israel, Kol Israel	6280va	9435af	11605va	15640va
2000	2030		Mongolia, Voice of	12015eu			
2000	2030	mtwhf/vl	Solomon Islands, SIBC	5020do	9545do		
2000	2030		Switzerland, Swiss R Intl	9755va	13660va	15485va	17660va
2000	2030		Vatican City, Vatican Radio	7365af	9660af	11625af	
2000	2045		Germany, Deutsche Welle	6180eu			
2000	2045		Iraq, Radio Iraq Intl	9687ing	11787eu		
2000	2050		New Zealand, Radio NZ Intl	15265pa			
2000	2056		China, China Radio Intl	5965eu	9440eu	9840eu	11640af
			13630af				11790eu
2000	2100		Algeria, Radio Algiers Intl	11715eu	15160eu		
2000	2100		Anguilla, Caribbean Beacon	11775am			
2000	2100		Australia, Radio	7240va	9475as	9500as	9580va
			11880va	12080va	21820as		9815pa
2000	2100		Australia, Voice International	13770as			
2000	2100	vi	Botswana, Radio	3356do	4820do	7255do	
2000	2100		Canada, CBC Northern Service	9625do			
2000	2100		Canada, CFRX Toronto ON	6070do			
2000	2100		Canada, CFVP Calgary AB	6030do			
2000	2100		Canada, CKZN St John's NF	6160do			
2000	2100		Canada, CKZU Vancouver BC	6160do			
2000	2100		Costa Rica, R for Peace Intl	15040am			
2000	2100		Costa Rica, University Network	5030am	6150am	7375am	9725sa
			11870am	13750na	17645as		
2000	2100		Ecuador, HCJB	11895eu			
2000	2100	mtwhf	Eqt Guinea, Radio Africa	15185af			
2000	2100	vi	Ghana, Ghana BC Corp	3366do	4915do		
2000	2100		Guam, AWR/KSDA	7160as	11700as		

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Shortwave Guide



2200 UTC - 6PM E / 5PM C / 3PM P

2200	2227	Iran, VOIRI 9780as	11740au				
2200	2228	Hungary, Radio Budapest	6025eu	11885af			
2200	2229	Canada, Radio Canada Intl	5850va	6045va	9770va	9805va	
2200	2230	India, All India Radio	7410eu	9445eu	9575au	9910au	9950eu
		11620va	11715au				
2200	2230	Serbia Montenegro, RYugoslavia	6100eu				
2200	2230	South Korea, R Korea Intl	3955eu				
2200	2230	Turkey, Voice of	9525va				
2200	2230	USA, Voice of America	6035af	7215va	7415af	9770va	9890va
		11655af	11760va	11975af	13710af	15185va	15290va
		15305va	17735va	17820va			
2200	2245	Egypt, Radio Cairo	9990eu				
2200	2245	USA, WYFR Okeechobee FL	15565af				
2200	2256	China, China Radio Intl	7170eu				
2200	2300	Anguilla, Caribbean Beacon	6090am				
2200	2300	Australia, ABCNT Alice Springs	2310do	4835irr			
2200	2300	Australia, ABCNT Katherine	5025do				
2200	2300	Australia, ABCNT Tennant Crk	4910do				
2200	2300	Australia, Radio	5995pa	6020pa	9580va	11650va	
		11660as	13620as	15230as	17715va	17795va	21740va
2200	2300	Bulgaria, Radio	5800eu				
2200	2300	Canada, CBC Northern Service	9625do				
2200	2300	Canada, CFRX Toronto ON	6070do				
2200	2300	Canada, CFVP Calgary AB	6030do				
2200	2300	Canada, CKZN St John's NF	6160do				
2200	2300	Canada, CKZU Vancouver BC	6160do				
2200	2300	Costa Rica, R for Peace Intl	7445am	15040am			
2200	2300	Costa Rica, University Network	5030am	6150am	7375am	9725sa	
		11870am	13750na	17645as			
2200	2300	mtwhf					
2200	2300	vt					
2200	2300	Eat Guinea, Radio Africa	15185af				
2200	2300	Ghana, Ghana BC Corp	3366do	4915do			
2200	2300	Guyana, Voice of	3290do	5950do			
2200	2300	Liberia, R Liberia Intl	5100do				
2200	2300	Malaysia, Radio	7295do				
2200	2300	Mexico, Radio Mexico Intl	9705am	11770am			
2200	2300	Namibia, NBC	3270af				
2200	2300	New Zealand, Radio NZ Intl	17675pa				
2200	2300	Nigeria, Radio/Enugu	6025do				
2200	2300	Nigeria, Radio/Kaduna	4770do	6090do	9570do		
2200	2300	Nigeria, Radio/Lagos	3326do	4990al			
2200	2300	Nigeria, Voice of	7255af	15120af			
2200	2300	Russia, University Network	9890as				
2200	2300	Solomon Islands, SIBC	5020do	9545do			
2200	2300	Spain, R Exterior Espana	9595af	9680eu			
2200	2300	Sri Lanka, SLBC	4940as				
2200	2300	Taiwan, R Taipei Intl	9355eu				
2200	2300	UK, BBC World Service	5965as	5975va	6195va	7105as	
		11685as	12095va	15400af	17830af		
2200	2300	Ukraine, R Ukraine Intl	5905eu	6020eu	7240eu	7375eu	9560eu
2200	2300	USA, Armed Forces Network	4993usb	6350usb	6458usb		
		13362usb					
2200	2300	USA, KAU Dallas TX	13815va				
2200	2300	USA, KTBN Salt Lk City UT	15590na				
2200	2300	USA, KWHR Naalehu HI	17510as				
2200	2300	USA, WBCQ Kennebunk, ME	7415na	9335na	17495na		
2200	2300	USA, WEWN Birmingham AL	9975na	17595na			
2200	2300	USA, WHRA Greenbush ME	7580va	17650va			
2200	2300	USA, WHRI Noblesville IN	5745va	9495va			
2200	2300	USA, WINB Red Lion PA	13570am				
2200	2300	USA, WJIE Louisville KY	7490am	13595am			
2200	2300	USA, WRMI Miami FL	15725na				
2200	2300	USA, WRNO New Orleans LA	7395am				
2200	2300	USA, WSHB Cypress Creek SC	7510eu				
2200	2300	USA, WSHB Cypress Creek SC	15285sa				
2200	2300	USA, WTJC Newport NC	9370na				
2200	2300	USA, WWCR Nashville TN	5070na	7465na	9475na		
		13845na					
2200	2300	USA, WWRB Manchester TN	9320na	12172na			
2200	2300	USA, WYFR Okeechobee FL	11740na				
2200	2300	Vanuatu, Radio	3945al	7260do			
2200	2300	Zambia, Christian Voice	4965do				
2205	2230	Italy, RAI Intl	11895as				
2230	2255	Belgium, Radio Vlaanderen Intl	13700na				
2230	2257	Czech Rep, Radio Prague Intl	7345va	9435va			
2230	2300	Albania, Radio Tirana Intl	7130eu	9540eu			
2230	2300	Australia, Radio	9475as				
2230	2300	Cuba, Radio Havana	6195am				
2230	2300	Sweden, Radio	6065va				
2245	2300	India, All India Radio	9705as	9950as	11620as	13605as	

2300 UTC - 7PM E / 6PM C / 4PM P

2300	0000	Anguilla, Caribbean Beacon	6090am				
2300	0000	Australia, ABCNT Alice Springs	2310do	4835irr			
2300	0000	Australia, ABCNT Katherine	5025do				
2300	0000	Australia, ABCNT Tennant Crk	4910do				
2300	0000	Australia, Radio	9475as	9580va	9660pa	11650pa	11660as
		12080va	13620as	15230as	17715va		
2300	0000	Bulgaria, Radio	9400na	11700na			
2300	0000	Canada, CBC Northern Service	9625do				
2300	0000	Canada, CFRX Toronto ON	6070do				
2300	0000	Canada, CFVP Calgary AB	6030do				
2300	0000	Canada, CKZN St John's NF	6160do				
2300	0000	Canada, CKZU Vancouver BC	6160do				
2300	0000	China, China Radio Intl	5990na	13680na			
2300	0000	Costa Rica, R for Peace Intl	7445am	15040am			
2300	0000	Costa Rica, University Network	5030am	6150am	7375am	9725sa	
		11870am	13750na	17645as			
2300	0000	Egypt, Radio Cairo	9900am				
2300	0000	vt					
2300	0000	Ghana, Ghana BC Corp	3366do	4915do			
2300	0000	Guyana, Voice of	3290do	5950do			
2300	0000	India, All India Radio	9705as	9950as	11620as	13605as	
2300	0000	Liberia, R Liberia Intl	5100do				
2300	0000	Malaysia, Radio	7295do				
2300	0000	Mexico, Radio Mexico Intl	9705am	11770am			
2300	0000	Namibia, NBC	3270af				
2300	0000	New Zealand, Radio NZ Intl	17675pa				
2300	0000	Romania, R Romania Intl	7195eu	9510na	9570eu		
		11940na					
2300	0000	Russia, University Network	9890as				
2300	0000	Singapore, SBC Radio One	6150do				
2300	0000	Sri Lanka, SLBC	4940as				
2300	0000	UK, BBC World Service	3915as	5965as	5975va	6195va	7105as
		11685as	11945as	11955as	12095va	15280as	
2300	0000	USA, Armed Forces Network	3903usb	4278usb	4319usb	4993usb	
		6350usb	6458usb	10320usb	12579usb	12689usb	13362usb
2300	0000	USA, KAU Dallas TX	13815va				
2300	0000	USA, KTBN Salt Lk City UT	15590na				
2300	0000	USA, KWHR Naalehu HI	17510as				
2300	0000	USA, Voice of America	6180va	7215va	7205va	9620va	9770va
		9780va	11735va	11760va	11805va	13640va	15135va
		15205va	15290va	15135va	17735va	17820va	
2300	0000	USA, WBCQ Kennebunk, ME	7415na	9335na	17495na		
2300	0000	USA, WEWN Birmingham AL	9975na	17595na			
2300	0000	USA, WHRA Greenbush ME	7580eu				
2300	0000	USA, WHRI Noblesville IN	5745va	9495va			
2300	0000	USA, WINB Red Lion PA	12160am				
2300	0000	USA, WJIE Louisville KY	7490am	13595am			
2300	0000	USA, WRMI Miami FL	15725na				
2300	0000	USA, WRMI Miami FL	15725na				
2300	0000	USA, WRNO New Orleans LA	7355am				
2300	0000	USA, WSHB Cypress Creek SC	7510af				
2300	0000	USA, WTJC Newport NC	9370na				
2300	0000	USA, WWCR Nashville TN	3210na	5070na	7465na		
		13845na					
2300	0000	USA, WWRB Manchester TN	5050na	5085na	6890na	15400as	
2300	0000	USA, WYFR Okeechobee FL	5985sa	11855sa	15170sa		
2300	0000	Vanuatu, Radio	3945al	7260do			
2300	0000	Zambia, Christian Voice	4965do				
2300	2329	Canada, Radio Canada Intl	5960am	9590am	11865am		
2300	2330	Cuba, Radio Havana	9550am				
2300	2330	Nigeria, Radio/Enugu	6025do				
2300	2330	Nigeria, Radio/Kaduna	4770do	6090do			
2300	2330	Nigeria, Radio/Lagos	3326do	4990al			
2300	2330	Solomon Islands, SIBC	5020do	9545do			
2300	2345	Germany, Deutsche Welle	9470as	9815as	13690as	21790as	
2300	2345	USA, WYFR Okeechobee FL	11740na				
2300	2350	Turkey, Voice of	6020va	9655va			
2320	2330	Kyrgyz, Kyrgyz Radio	4010as	4795as			
2330	0000	Australia, Radio	11695as	15415as			
2330	0000	Canada, Radio Canada Intl	5960na	9590na			
2330	0000	Lithuania, R Vilnius	9875eu				
2330	0000	Netherlands, Radio	6165na	9845na			
2330	0000	Switzerland, Swiss R Intl	9885sa	11660sa			
2330	0000	UAE, Gospel For Asia	6145as				
2330	0000	UK, BBC World Service	6035as				
2330	2345	Libya, Voice of Africa	15435irr	21695irr			
2330	2356	China, China Radio Intl	5990na	13680na			
2330	2357	Czech Rep, Radio Prague Intl	9745na	21455usb			
2330	2357	Vietnam, Voice of	9840as	12020as			

**Notes:**

1. Due to print deadlines, these schedules for the first month of the spring/summer broadcast season were prepared prior to any formal announcements by the various stations of their upcoming schedules. Most of the information herein is based on stations' past practice, which has proven to be a generally accurate methodology. Nonetheless, some errors are unavoidable under these circumstances.

2. **BBCWS stream abbreviations:** (am)=Americas; (eas)=East Asia.

3. **Listings for the US-based independent shortwave broadcasters** are limited to general interest programming that departs from their primary formats of religious and political fare.

4. At press time, there was a possibility that **Radio Österreich International's English Service** would be discontinued by the end of March.

5. At press time, there were some indications that **Radio Netherlands** might make significant alterations to its program and transmission schedules.

0000 UTC/ 8pm E/5pm P - Page 43 Freqs

BBC WORLD SERVICE (am)

0000 S/M The World Today, T-A News; 0005 T Meridian-Masterpiece, W Meridian-Screen, H Meridian-Writing, F The Music Biz A Arts in Action; 0030 S World Business Review, T Charlie Gillett (world music), W UK Top 20, H Revolver (musician's picks), F John Peel (eclectic), A Jazzmatazz; 0045 S Letter from America (Alistair Cooke).

HCJB Ecuador

0000 S DX Partyline, M Musical Mailbag, T-A News; 0010 T-A Studio 9 (on Latin America); 0030 S Saludos Amigos, M Mountain Meditations, T Inspirational Classics, W Words for Women, H Walkin' in the Sunshine (country music), F Book & Spade (archaeology), A Musica del Ecuador (folk); 0045 W Wonderful Words of Life (hymns), F Science, Scripture & Salvation.

RADIO AUSTRALIA

0000 D News; 0005 S Go Zone (pop music), A Australian Express (magazine); 0010 M AWAYE! (Aboriginal culture), T The Science Show, W The National Interest (Australian politics), H Background Briefing (documentary), F Hindsight (Australian history); 0030 A Country Breakfast (rural life); 0035 Ockham's Razor (science opinion).

RADIO EXTERIOR ESPANA

0000 S Visitors Book (travelers to Spain), M Window on Spain (culture), T-A News (international, Spain, Latin America); 0015 S/M Spanish history or culture series; 0025 S/M Rebroadcast of 0035 weekday programs, T-A Spanish pop music; 0030 T-A Press Review; 0035 S/T Radio Waves, W Chronicles (Spain & the US), H Entremeses (food & travel), F Africa Today, A Radio Club (letters); 0045 T-A A Language Without Bounds (Spanish lesson).

RADIO JAPAN - NHK WORLD

0000 D News; 0010 S Hello from Tokyo (listener contact), M Weekend Square; 0015 T-A 44 Minutes (magazine).

RADIO NETHERLANDS

0000 S/W Music 52-15 (international music), M Dutch Horizons, T Research File (science), H Documentary, F Aural Tapestry (culture), A A Good Life (development issues); 0030 S Amsterdam Forum (conversations), M Aural Tapestry, T EuroQuest (Europe in context), W A Good Life, H Dutch Horizons, F Research File, A Documentary.

RADIO NEW ZEALAND INT.

0000 S/A News; M-F Midday Report; 0012 S This Week in Parliament, A Focus on Politics; 0033 S Spectrum

(life in NZ), A The Sampler (latest CDs).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0000 S World of Radio, M Spiritual Awakening, T-A Freespeech Radio News (Pacifica Reporters Against Censorship daily newscast); 0030 S RFPI Mailbag, M World of Radio, T/H/A Hightower Radio (commentary), W Counterspin (media analysis), F This Way Out (lesbian/gay magazine); 0035 T/H/A Earthwatch (ecology); 0040 T/H/A Earth & Sky (astronomy); 0045 T Tropical Conservation Newsbureau (rainforests), H World Citizen's Weekly Commentary, A Women (UN program).

RADIO PRAGUE

0000 D News; 0005 S Magazine (local color), M Letter from Prague, T-A Newsview; 0010 S Saturday Music (a mix), M Mailbox, T One on One (interview), W Witness (oral history), H ABC of Czech (language), F Economic Report, A The Arts; 0020 M Readings from Czech Literature, W Talking Point (Czech issues), H Czechs in History or Spotlight (travelogue), A Away from Politics (poetry).

VOICE OF AMERICA (News Now)

0000 T-A News and Reports; 0015 T-A Focus (a topic in-depth); 0023 T-A Sports; 0030 T-A News Headlines; 0033 T-A Coast to Coast (American life); 0055 Government Editorial.

WBCQ, Maine

7415 kHz.: 0000 S A Different Kind of Oldies Show, M Radio New York International, W Good Morning Maine, A Allan Weiner Worldwide.

0100 UTC/ 9pm E/6pm P - Page 43 Freqs

BBC WORLD SERVICE (am)

0100 D News; 0105 S Composer of the Month, M Wright Around the World (musical variety), T Health Matters, W Go Digital, H Discovery (science), F One Planet (ecology), A Science in Action; 0130 S Music Review, T Everywoman, W Omnibus (documentary), H Sports International, F/A Documentaries.

CHINA RADIO INTERNATIONAL

0100 D News & Reports; 0110 S Report on Developing Countries; 0115 A Cutting Edge (sci/tech); 0120 S In the Spotlight (cultural magazine); 0130 M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

HCJB, Ecuador

0100 S Ham Radio Today, M Hour of Decision, T-A A New Beginning; 0115 T-A Slice of Infinity; 0130 S Studio 9 Weekend, M Renewing Your Mind, T-A Insight for Living; 0158 T-A Money Minute.

RADIO AUSTRALIA

0100 D News; 0105 S Correspondents' Report, A Asia Pacific (regional current affairs); 0110 M-F Asia Pacific; 0130 S Oz Sounds (new music releases), M Health Report, T Law Report, W Religion Report, H Media Report, F The Sports Factor, A RA Arts.

[Special service: 0105 S/A Grandstand (live sports action) on 9660, 12080, 17580, 21725 kHz. only.]

RADIO BUDAPEST

0100 D News; 0105 S Insight Central Europe; M Europe Unlimited (trade) or Heading for Hungary (travel) or Spotlight (culture) or And the Gatepost (letters), T-A Hungary Today (current events magazine); 0120 A DX Corner.

RADIO CANADA INTERNATIONAL

0100 D News; 0105 S Business Sense, M Maple Leaf Mailbag (w/CIDX report bimonthly); 0110 T-A Canada Today (current events magazine); 0135 S/A Canada in the World, M/H Spotlight (arts & culture), T Media Zone (journalists discuss), W Maple Leaf Mailbag (w/CIDX report bimonthly), F Business Sense.

RADIO HABANA CUBA

0100 D International News; 0110 M Weekly Review, T-S National News; 0115 T-S Viewpoint; 0130 M Reports & Music, T-S News Bulletin; 0135 T-A Time Out (sports); 0140 S/W DXers Unlimited, M Mailbag Show, T/H/F Caribbean Outlook, A Weekly Review; 0150 M Breakthrough (science report).

RADIO NETHERLANDS

0100 S/M News, T-A Newsline; 0105 S Europe Unzipped, M Wide Angle (one issue focus).

RADIO NEW ZEALAND INTERNATIONAL

0100 D RNZ News; 0106 S At the Movies, M-F Cadenza (light classics), A Digital Life; 0130 S Bookmarks.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0100 S Making Contact, M Radio Nation ("The Nation" magazine), T Disability Radio Worldwide, W World of Radio, H A Public Affair, F Far Right Radio Review, A Continent of Media; 0130 S Alternative Radio (political/social analysis), T This Way Out (gay/lesbian magazine), W RFPI Mailbag, A World of Radio.

RADIO PRAGUE

0100 D News; 0105 S Insight Central Europe, M Letter from Prague, T-A Newsview; 0110 M Mailbox, T One on One (interview), W Witness (oral history), H ABC of Czech (language), F Economic Report, A The Arts; 0120 M Readings from Czech Literature, W Talking Point (Czech issues), H Czechs in History or Spotlight (travelogue), A Away from Politics (poetry).

RADIO SLOVAKIA INTERNATIONAL

0100 D News; 0105 S Front Page Review (Slovak press), M Weekly Newsreel T-A Topical Issue; 0110 S Various features, M Listeners' Tribune (letters, magazine, Slovak music), T Tourism News or Environmental Update, W Slovakia in an International Context, H Business News, F Culture News or Back Page News (the off-beat), A Education, Science and Regional News.

RADIO UKRAINE INTERNATIONAL

0100 D News; 0110 S Ukrainian Diary (weekly review), M Music from Ukraine, T-A Ukraine Today (magazine); 0115 S The Whole World on the Radio Dial (DX program); 0130 S Hello From Kiev (listener letters/music), M Roots (culture & education); 0145 T-A Closeup (current issues).

VOICE OF AMERICA (News Now)

0100 T-A News and Reports; 0123 T-A Sports; 0130 T-A News Headlines; 0133 T-F Business Report, A VOA News Review; 0145 T-F Dateline (news magazine); 0155 T-F Government Editorial.

VOICE OF RUSSIA

0100 D News; 0111 S News & Views, M Sunday Panorama, T-A Commonwealth Update; 0124 M Russia: People & Events; 0130 D News in Brief; 0132 S Moscow Yesterday & Today, M Timelines, T Folk Box, W Jazz Show, H Musical Portraits, F Music Around Us, A Christian Message from Moscow; 0146 F Music At Your Request; 0154 H Russia: People & Events.

VOICE OF VIETNAM

0100 D News; 0105 D Current Affairs; 0110 S Weekly Review, M Sunday Show, T/W/F/A Press Review, H Talk of the Week; 0115 T Vietnam: Land & People, W Culture & Society, H Letterbox, F Vietnam Economy, A Rural Vietnam; 0120 S Music, A Literature and Arts.

WBCQ, Maine

7415 kHz.: 0100 S Marion's Attic (vintage recordings), M Radio New York International (cont'd), W Torah Talks, A Tasha Takes Control.

RADIO OSTERREICH INTERNATIONAL

0130 S Insight Central Europe, M Letter from Austria, T-A Report from Austria (magazine); 0135 M Network Europe; 0150 S Postbox.

RTE, Ireland

0130 S Saturday View, M This Week with Gerald Barry, T-A 5-7 Live (top news of the day).

Shortwave Guide



VOICE OF AMERICA (Special English)

0130 T-A News; **0140** T Agriculture Today, W/H Science Report, F Environment Report, A In the News; **0145** T Science in the News, W Explorations, H Making of a Nation, F American Mosaic; A American Stories.

0200 UTC/ 10pm E/7pm P - Page 43 Freqs

BBC WORLD SERVICE (am)

0200 D World Briefing; **0220** D Sports Roundup; **0230** S Reporting Religion, M Assignment, T-A World Business Report; **0245** T/W/F/A Analysis, H From Our Own Correspondent.

HCJB, Ecuador

0200 S Studio 9 Weekend (continues), M The Sower, T-A Stories of Great Christians; **0215** M The Word Today, T-A Rendezvous; **0230** S Did You Hear?, M Let My People Think, T-A Back to the Bible; **0245** S Specialized English; **0255** T-A Joni and Friends.

RADIO AUSTRALIA

0200 D News; **0205** S Margaret Throsby (interviews and music), A Background Briefing (documentary); **0210** M-F The World Today (ABC Radio flagship news program).

[Special service: **0205** S/A Grandstand (live sports action) on 9660, 12080, 17580, 21725 kHz. only.]

RADIO BULGARIA

0200 D News; **0210** S Views Behind the News, M Folk Studio (Bulgarian folk music), T-A Events and Developments; **0220** T Sports; **0225** W-S Timeout for Music; **0230** T Bulgarian Plaza (cultural magazine) or Walks and Talks (interesting places); **0235** T Answering Your Letters, W-M Keyword Bulgaria (Bulgaria and things Bulgarian); **0245** S Radio Bulgaria Calling (for radio hobbyists), W Magazine Economy, H Arts and Artists, F History Club, A The Way We Live.

RADIO HABANA CUBA

0200 D International News; **0210** M From Habana (Cuban musicians), T-S National News; **0215** T-S Reports and music; **0230** M The Jazz Place or Top Tens, T-S News Bulletin; **0235** S World of Stamps, T-A Reports and music; **0250** S Cuban music.

RADIO KOREA INTERNATIONAL

0200 D News; **0210** S Friendship Unlimited (letters, DX news), M Korean Pop Interactive (requests), T-A News Commentary; **0215** T-A Seoul Calling (magazine); **0230** T Korea Today & Tomorrow, W Cultural Promenade, H Economic Radar, F Korea & Its Splendors, A Notes of Nostalgia (traditional music).

RADIO NEW ZEALAND INTERNATIONAL

0200 D RNZ News; **0205** S Music feature, M-F In Touch with New Zealand (music, interviews, variety), A Eureka! (science)*; **0230** S The Band Programme (brass band music), A Health or Environment Matters.

[*may be preempted by live sport]

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0200 S Alternative Radio (cont'd.), M New Dimensions ("progressive" ideas), T University Forum (interviews), W Continent of Media, H WINGS (women's news), F Disability Radio Worldwide, A RFPI Mailbag; **0230** S Far Right Radio Review, T Honoring Mother Earth: Indigenous Voices, W A World of Possibilities, H Global Community Forum (interviews), F A Woman's Voice, A University Forum (interviews).

RADIO ROMANIA INTERNATIONAL

0200 D Radio Newsreel; **0210** S The Week, M Focus, T-A Commentary; **0215** S World of Culture, M Sunday Studio, T Pro Memoria (history), W Business Club, H Society Today, F Cards on the Table (debate) or The Romanian Next to You (interview), A Challenge for the Future or Terra 2001; **0220** S RRI Encyclopedia, T Political Flash, W European Horizons; **0225** S Roots (culture/traditions), M Romanian by Radio, T/H/A Business Update, W Tourist News, F Listeners' Letterbox; **0230** S Radio Pictures, M Romanian Itineraries, T Pulse of Transition, W W Mother Nature (ecology), H Visit Romania, A Practical Guide; **0235** S Romanian Itineraries, M Listeners' Letterbox, T Performing Arts, W Youth Club, H Partners in a Changing World, A Cultural Survey; **0240** S, Bucharest Along the Centuries, T Pages of Romanian Literature, W/F Skylark (folk music), H Stage and Screen, A Spectator (voice of the people); **0245** S DX Mailbag, T Romanian Hits, H Romanian Musicians, A Romanian Folk Music At Its Best; **0250** M Romanian Folk Music At Its Best, T Sports Roundup, W Athlete of the Week, H Sports Club, F Football Flash, A Sports Weekend.

0245 S DX Mailbag, T Romanian Hits, H Romanian Musicians, A Romanian Folk Music At Its Best; **0250** M Romanian Folk Music At Its Best, T Sports Roundup, W Athlete of the Week, H Sports Club, F Football Flash, A Sports Weekend.

RADIO TAIPEI INTERNATIONAL

0200 D News; **0215** S Great Wall Forum (discussing the mainland), M Jade Bells & Bamboo Pipes (traditional music), T Culture Express, W Taiwan Today, H Discover Taiwan, F Taipei Magazine, A Groove Zone; **0230** S Mailbag Time, T Trends, W Confucius and Inspiration Beyond, H New Music Lounge, F People; **0245** M-F Let's Learn Chinese (M/W/F elementary, T/H intermediate), A Kaleidoscope (life in Taiwan).

[This schedule also airs at **0700** for western North America.]

VOICE OF RUSSIA

0200 D News; **0211** S/M/H Moscow Mailbag, T/F Science & Engineering, W/A Newmarket (business); **0230** D News in Brief; **0232** S Songs from Russia, M This is Russia, T Kaleidoscope (Russian events), W Musical Portraits, H Moscow Yesterday & Today, F Russian by Radio, A Audio Book Club (Russian lit.); **0246** S You Write to Moscow; **0254** W Russia: People & Events.

WBCQ, Maine

7415 kHz.: **0200** S Pocket Calculator (about small electronic devices), M Radio New York International (cont'd).

WHRA, Maine

7580 kHz.: **0230** S DXing with Cumbre.

WHRI, Indiana

5745 kHz.: **0230** M DXing with Cumbre.

WWCR, Tennessee

5070 kHz.: **0230** S World of Radio.

RADIO BUDAPEST

0230 D News; **0235** S Insight Central Europe; M Europe Unlimited (trade) or Heading for Hungary (travel) or Spotlight (culture) or And the Gatepost (letters), T-A Hungary Today (current events magazine); **0250** A DX Corner.

RADIO SWEDEN

0230 S Network Europe (Europe magazine-1st week)/Sweden Today (2nd)/Spectrum (arts magazine-3rd)/Studio 49 (topical discussion-4th), M In Touch with Stockholm (listener contact-1st)/Sounds Nordic (rock music-exc. 1st), T-A Sixty Degrees North (regional report); **0245** T Sports Scan, W Close Up (profiles of Swedes-1st/3rd), F Nordic Report (1st)/Green Scan (ecology-2nd)/Heart Beat (health-3rd)/The S-Files (things Swedish-4th), A Review of the Newsweek.

VOICE OF VIETNAM

0230 D News; **0235** D Current Affairs; **0240** Su Weekly Review, M Sunday Show, T/W/F/A Press Review, H Talk of the Week; **0245** T Vietnam: Land & People, W Culture & Society, H Letterbox, F Vietnam Economy, A Rural Vietnam; **0250** S Music, A Literature and Arts.

0300 UTC/ 11pm E/8pm P - Page 44 Freqs

BBC WORLD SERVICE (am)

0300 S/M The World Today, T-A News; **0305** T Jazzmatazz, W Charlie Gillett (world music), H John Peel (eclectic), F Composer of the Month, A Just a Minute (comedic panel game); **0330** S Global Business, M Westway Omnibus (drama serial), T/F World Learning Features, W Write On (letters), H Heart & Soul (spiritual matters), A Patterns of Faith; **0345** T-A Off the Shelf (book readings).

CHINA RADIO INTERNATIONAL

0300 D News & Reports; **0310** S Report on Developing

Countries; **0315** A Cutting Edge (sci/tech); **0320** S In the Spotlight (cultural magazine); **0330** M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

HCJB, Ecuador

0300 S DX Partyline, M Musical Mailbag, T-A News; **0310** T-A Studio 9 (on Latin America); **0330** S Saludos Amigos, M Mountain Meditations, T Inspirational Classics, W Words for Women, H Walkin' in the Sunshine (country music), F Book & Spade (archaeology), A Musica del Ecuador (folk); **0345** W Wonderful Words of Life (hymns), F Science, Scripture & Salvation.

RADIO AUSTRALIA

0300 D News; **0305** S Feedback (letters, station news, on communications), A Rural Reporter; **0310** M-F Regional Sports Report; **0320** M-F Pacific Focus (M business, T health, W environment, H sport, F culture); **0330** S All in the Mind, A In Conversation (about science); **0340** M Oz Music Show (rock), T Music Deli (diverse world/folk), W Blacktracker (contemporary Aboriginal music), H Australian Country Style, F Jazz Notes.

[Special service: **0305** S/A Grandstand (live sports action) on 9660, 12080, 17580, 21725 kHz. only.]

RADIO HABANA CUBA

0300 D International News; **0310** M Weekly Review, T-S National News; **0315** T-S Viewpoint; **0330** M Reports & Music, T-S News Bulletin; **0335** T-A Time Out (sports); **0340** S/W DXers Unlimited, M Mailbag Show, T/H/F Caribbean Outlook, A Weekly Review; **0350** M Breakthrough (science report).

RADIO NEW ZEALAND INTERNATIONAL

0300 S/A* RNZ News, M-F Pacific Regional News; **0305** S RPM (international documentaries)*, A The Mix (new music)*; **0310** M Tagata o te Moana, T Top 5, W Pacific Report, H Mailbox (letters & DX news) or RNZI Talk (station info), F Dateline Pacific; **0330** T New Releases, W Tradewinds (Pacific commerce), H The World in Sport, F Pacific Correspondent.

[*may be preempted by live sport]

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0300 S Far Right Radio Review (cont'd), M Voices of Our World (Maryknoll program), T Honoring Mother Earth: Indigenous Voices (cont'd), W Living Enrichment Center, H Global Community Forum (cont'd), F A Woman's Voice (cont'd), A A World of Possibilities; **0330** S World Citizens Weekly Commentary, M Perspective (UN program), T In the Moment, W Peace Forum, H Scope (UN program), F Tropical Conservation Newshour (rainforests), A Newmaier Report; **0345** S/M Hightower Report (commentary), T-A UN Today; **0348** S/M Earthwatch (ecology); **0351** S/M Earth & Sky (astronomy); **0355** S/M World Opinion (on terrorism).

RADIO PRAGUE

0300 D News; **0305** S Magazine (local color), M Letter from Prague, T-A Newsview; **0310** S Saturday Music (a mix), M Mailbox, T One on One (interview), W Witness (oral history), H ABC of Czech (language), F Economic Report, A The Arts; **0320** M Readings from Czech Literature, W Talking Point (Czech issues), H Czechs in History or Spotlight (travelogue), A Away from Politics (poetry).

RADIO TAIPEI INTERNATIONAL

0300 D News; **0315** S Great Wall Forum (discussing the mainland), M Taiwan Economic Journal, T Jade Bells & Bamboo Pipes (traditional music), W New Music Lounge, H Taipei Magazine, F Taiwan Gourmet, A Kaleidoscope (life in Taiwan); **0330** S Asia Pacific (from Radio Australia), M People, W Confucius & Inspiration Beyond, H Life Unusual, F Discover Taiwan, A Mailbag Time; **0345** M-F Let's Learn Chinese (M/W/F elementary, T/H intermediate).

VOICE OF AMERICA, Africa Service

0300 S/A News & Reports, M-F Daybreak Africa (morning newsmagazine); **0323** S/A Sports; **0330** D News Headlines; **0333** S Issues in the News, M-F Business Report, A Our World (ecology, science & technology);

Shortwave Guide



0345 M-F Dateline (documentary); **0355** M-F Government Editorial.

VOICE OF RUSSIA

0300 D News; **0311** M Sunday Panorama, T-S News & Views; **0324** M Russia: People & Events; **0330** D News in Brief; **0332** S Kaleidoscope (Russian events), M Audio Book Club (Russian lit.), T/H/A 20th Century, W/F Russian history/culture.

VOICE OF TURKEY

0300 D News; **0310** D Press Review; **0315** S Outlook, M Tunes Spanning Centuries, T Last Week, W Live From Turkey, H Review of the Foreign Media, F Big Powers & the Armenian Problem, A Archaeological Settlements in Turkey; **0320** S The Stream of Love or DX Corner, T Hues & Colors of Anatolia, H Letterbox; **2225** M/A Music, F In the Wake of a Contest; **0330** S/T Music; **0335** S Turkish Arts, M Turks in the Mirror of Centuries, T From Past to Present, H Turkey's Off the Beaten Track Sites, F The Culture Parade, A The Travel Itinerary of Anatolia.

KWHR, Hawaii

17510 kHz.: **0300** M DXing with Cumbre.

WBCQ, Maine

7415 kHz.: **0300** S You Are What You Think, M Radio New York International (cont'd).

WHRI, Indiana

7315 kHz.: **0330** M DXing with Cumbre.

WWCR Tennessee

3215 kHz.: **0305** A The Golden Age of Radio Theatre. 5070 kHz.: **0300** S Spectrum (communications discussion).

RADIO SWEDEN

0330 S Network Europe (Europe magazine-1st week)/Sweden Today (2nd)/Spectrum (arts magazine-3rd)/Studio 49 (topical discussion-4th), M In Touch with Stockholm (listener contact-1st)/Sounds Nordic (rock music-exc. 1st), T-A Sixty Degrees North (regional report); **0345** T Sports Scan, W Close Up (profiles of Swedes-1st/3rd), F Nordic Report (1st)/Green Scan (ecology-2nd)/Heart Beat (health-3rd)/The S-Files (things Swedish-4th), A Review of the Newsweek.

VOICE OF VIETNAM

0330 D News; **0335** D Current Affairs; **0340** Su Weekly Review, M Sunday Show, T/W/F/A Press Review, H Talk of the Week; **0345** T Vietnam: Land & People, W Culture & Society, H Letterbox, F Vietnam Economy, A Rural Vietnam; **0350** S Music, A Literature & Arts.

0400 UTC/ 12am E/9pm P - Page 45 Freqs

BBC WORLD SERVICE (am)

0400 D The World Today; **0430** S Global Business, A Assignment; **0450** M-F Sports Roundup.

CHINA RADIO INTERNATIONAL

0400 D News & Reports; **0410** S Report on Developing Countries; **0415** A Cutting Edge (sci/tech); **0420** S In the Spotlight (cultural magazine); **0430** M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

HCJB, Ecuador

0400 S Ham Radio Today, M Hour of Decision, T-A A New Beginning; **0415** T-A Reaching Your World; **0430** S Studio 9 Weekend, M Renewing Your Mind, T-A Insight for Living; **0458** T-A Money Minute.

RADIO AUSTRALIA

0400 D News; **0405** S/A Pacific Focus (S arts, A environment); **0410** M-F Margaret Throsby (interviews and music); **0430** S RA Arts, A The Buzz (technology issues).

[Special service: **0405** S/A Grandstand (live sports action) on 9660, 12080, 17580, 21725 kHz. only.]

RADIO HABANA CUBA

0400 D International News; **0410** M From Habana (Cuban musicians), T-S National News; **0415** T-S Reports and music; **0430** M The Jazz Place or Top Tens, T-S News Bulletin; **0435** S World of Stamps, T-A Reports and music; **0450** S Cuban music.

RADIO NETHERLANDS

0430 S/M News; T-A Newline; **0435** S Europe Unzipped, M Sincerely Yours (letters); **0455** S Insight (commentary), M The Week Ahead (program previews).

RADIO NEW ZEALAND INTERNATIONAL

0400 D RNZ News*; **0405** S Sunday Drama* (radio plays), M-F In Touch with New Zealand (cont'd), A Home Grown (NZ music, including *Musical Chairs*-artist feature **0430**).

[*may be preempted by live sport].

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0400 S CounterSpin (media analysis), M A Public Affair, T-A Democracy Now!; **0430** S Freespeech Radio News (repeat of Fri. newscast).

RADIO ROMANIA INTERNATIONAL

0400 D Radio Newsreel; **0410** S The Week, M Focus, T-A Commentary; **0415** S World of Culture, M Sunday Studio, T Pro Memoria (history), W Business Club, H Society Today, F Cards on the Table (debate) or The Romanian Next to You (interview), A Challenge for the Future or Terra 2001; **0420** S RRI Encyclopedia, T Political Flash, W European Horizons; **0425** S Roots (culture/traditions), M Romanian by Radio, T/H/A Business Update, W Tourist News, F Listeners' Letterbox; **0430** S Radio Pictures, M Romanian Itineraries, T Pulse of Transition, W Mother Nature (ecology), H Visit Romania, A Practical Guide; **0435** S Romanian Itineraries, M Listeners' Letterbox, T Performing Arts, W Youth Club, H Partners in a Changing World, A Cultural Survey; **0440** S, Bucharest Along the Centuries, T Pages of Romanian Literature, W/F Skylark (folk music), H Stage and Screen, A Spectator (voice of the people); **0445** S DX Mailbag, T Romanian Hits, H Romanian Musicians, A Romanian Folk Music At Its Best; **0450** M Romanian Folk Music At Its Best, T Sports Roundup, W Athlete of the Week, H Sports Club, F Football Flash, A Sports Weekend.

RADIO UKRAINE INTERNATIONAL

0400 D News; **0410** S Ukrainian Diary (weekly review), M Music from Ukraine, T-A Ukraine Today (magazine); **0415** S The Whole World on the Radio Dial (DX program); **0430** S Hello From Kiev (listener letters/music), M Roots (culture & education); **0445** T-A Closeup (current issues).

RVi, Belgium

0400 S Music from Flanders, M Radio World, T-A News; **0404** T-A Flanders Today (incl. press review); **0408** M Tourism in Flanders, **0413** T Focus on Europe, W Green Society (ecology), H/A Around the Arts, F Economics; **0414** M Brussels 1043 (letters); **0418** T Sports, H Around Town, F International Report, A Tourism in Flanders; **0424** M-A Soundbox (Flemish music).

VOICE OF AMERICA, Africa Service

0400 D News & Reports; **0415** M-F Focus (a topic in-depth); **0423** D Sports; **0430** S/A News Headlines, M-F Daybreak Africa (morning newsmagazine); **0433** S Main Street (about America, incl. *Kim Elliott media report*), A Press Conference USA.

VOICE OF RUSSIA

0400 D News; **0411** S/M Musical Portraits, T/F Moscow Mailbag, W/A Science and Engineering, H Newmarket (business); **0430** D News in Brief; **0432** S/A Timelines, M Jazz Show, T Music Around Us, W Moscow Yesterday and Today, H Folk Box, F Audio Book Club (Russian lit.); **0447** T Music At Your Request.

WBCQ, Maine

7415 kHz.: **0400** S Tom & Darryl (electronic media), M-A Amos On Andy; **0415** M World of Radio, T-F EVM Jewish Radio Network; **0445** M Radio D.C.

WHRA, Maine

7580 kHz.: **0430** A DXing with Cumbre.

WWCR, Tennessee

5070 kHz.: **0400** S Cyber Line (digital communications).

0500 UTC/ 1am E/10pm P - Page 45 Freqs

CHANNEL AFRICA, South Africa

0500 S Network Africa (week in review), M-F Dateline Africa (news magazine), A Channel Africa Sport.

CHINA RADIO INTERNATIONAL

0500 D News & Reports; **0510** S Report on Developing Countries; **0515** A Cutting Edge (sci/tech); **0520** S In the Spotlight (cultural magazine); **0530** M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

HCJB, Ecuador

0500 S Studio 9 Weekend (continues), M The Sower, T-A Back to the Bible; **0515** M The Word Today, T-A The Gospel Truth; **0530** S Did You Hear?, M Let My People Think, T-A Family Life Today; **0545** S Specialized English.

RADIO AUSTRALIA

0500 D News; **0505** S/A Pacific Focus (S business, A sport); **0510** M-F Pacific Beat (Pacific islands magazine with regional sports report @ 0530); **0530** S Fine Music Australia (classical), A Lingua Franca (about language); **0545** A Business Weekend.

[Special service: **0505** S/A Grandstand (live sports action) on 9660, 12080, 17580, 21725 kHz. only.]

RADIO HABANA CUBA

0500 D International News; **0510** M Weekly Review, T-S National News; **0515** T-S Viewpoint; **0530** M Reports & Music, T-S News Bulletin; **0535** T-A Time Out (sports); **0540** S/W DXers Unlimited, M Mailbag Show, T/H/F Caribbean Outlook, A Weekly Review; **0550** M Breakthrough (science report).

RADIO JAPAN - NHK WORLD

0500 D News; **0510** S Pop Joins the World, A Hello from Tokyo (listener contact); **0515** M-F 44 Minutes (magazine).

RADIO NETHERLANDS

0500 S Amsterdam Forum (conversations), M Dutch Horizons, T Research File (science), W Music 52-15 (international music), H Documentary, F Aural Tapestry (culture), A A Good Life (development issues).

RADIO NEW ZEALAND INTERNATIONAL

0500 S/A RNZ News, M-F Checkpoint (major domestic evening news magazine); **0510** S Religion feature or series, A Home Grown (cont'd.); **0540** S Jazz Spotlight.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0500 S TUC Radio, M Neumaier Report, T Between the Lines, W A Woman's Voice, H Alternative Radio, F Making Contact, A Honoring Mother Earth: Indigenous Voices; **0515** M Living Enrichment Center; **0530** S Continent of Media, T TUC Radio, F Steppin' Out of Babylon.

VOICE OF AMERICA, Africa Service

0500 S News, M-A News & Reports; **0506** S Best of Talk to America; **0523** M-A Sports; **0530** D News Headlines; **0533** S Best of Talk to America, M-F Business Report, A VOA News Review; **0545** M-F Dateline (documentary); **0555** M-F Government Editorial.

VOICE OF NIGERIA

0500 S Reflections, M-F Wave Train (music), A African Safari (music); **0505** S Link-Up (music requests); **0530** S/A News, M-F VON Scope (news magazine).

WBCQ, Maine

7415 kHz.: **0500** S Juliet's Wild Kingdom, M Radio D.C. (cont'd), T-F EVM Jewish Radio Network (cont'd).

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WHRI, Indiana

5745 kHz.: **0500** A DXing with Cumbre.
7315 kHz.: **0500** A DXing with Cumbre.

0600 UTC/ 2am E/11pm P - Page 46 Freqs

CHANNEL AFRICA, South Africa

0600 S Network Africa (week in review), M-F Dateline Africa (news magazine), A Channel Africa Sport.

RADIO AUSTRALIA

0600 D News; **0605** S The Europeans, A Feedback (letters/station news/on communications); **0610** M-F Regional Sports Report; **0620** M-F Pacific Focus (M business, T health, W environment, H sport, F culture); **0630** A Oz Sounds (new releases); **0635** S Ockham's Razor (science issues); **0640** M Oz Music Show (rock), T Music Deli (diverse world/folk), W Blacktracker (contemporary Aboriginal music), H Australian Country Style, F Jazz Notes.

[Special service: **0605** S/A Grandstand (live sports action) on 9660, 12080, 17580, 21725 kHz. only.]

RADIO HABANA CUBA

0600 D International News; **0610** M From Habana (Cuban musicians), T-S National News; **0615** T-S Reports and music; **0630** M The Jazz Place or Top Tens, T-S News Bulletin; **0635** S World of Stamps, T-A Reports and music; **0650** S Cuban music.

RADIO JAPAN - NHK WORLD

0600 D News; **0610** S Weekend Square (Japanese life), A Pop Joins the World; **0615** M-F Asian Top News (headlines from region's radio); **0625** M Japan Music Log, T Let's Learn Japanese, W Japan Music Treasure Box, H Brush Up Your Japanese, F Music Beat.

RADIO NEW ZEALAND INTERNATIONAL

0600 D RNZ News; **0607** S Whenua (Maori magazine), M-F What's Going On? (arts & entertainment), A Tagata o te Moana (Pacific magazine); **0630** M-F Worldwatch (international news) **0645** M-F Pacific News.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

0600 S World of Radio, M Spiritual Awakening, T-A Freespeech Radio News (Pacifica Reporters Against Censorship daily newscast); **0630** S RFPI Mailbag, M World of Radio, T/H/A Hightower Radio (commentary), W Counterspin (media analysis), F This Way Out (lesbian/gay magazine); **0635** T/H/A Earthwatch (ecology); **0640** T/H/A Earth & Sky (astronomy); **0645** T Tropical Conservation Newsbureau (rainforests), H World Citizen's Weekly Commentary, A Women (UN program).

VOICE OF AMERICA, Africa Service

0600 S/A News & Reports, M-F Daybreak Africa (morning newsmagazine); **0623** S/A Sports; **0630** S/A News Headlines; **0633** S Main Street (about America, incl. Kim Elliott media report), A On the Line (US foreign policy).

VOICE OF NIGERIA

0600 S This Week on VON, M Across the Ages, T Agenda for Peace, W Nigerian Newsletter, H West African Scene, F African Writers, A From the Racks; **0615** S Listeners' Letters, M Nigeria & Politics, T Nigerian Scene, W Wheel of Progress, H World of the Arts, F Images of Nigeria, A Issues of the Moment; **0630** S/A Weekly Analysis, M-F World News; **0640** M-F Commentary & Press Review; **0645** M-F News about Nigeria.

KWHR, Hawaii

17780 kHz.: **0600** A DXing with Cumbre.

1000 UTC/6am E/3am P - Page 48 Freqs

BBC WORLD SERVICE (am)

1000 D World Briefing; **1020** S/A Sports Roundup; **1030** S Agenda (trends), M-F World Business Report, A Reporting Religion; **1045** M-F Sports Roundup.

BBC WORLD SERVICE (eas)

1000 S/A News, M-F World Briefing; **1001** S Concert Hall; **1005** A Composer of the Month; **1030** M-F World Business Report, A Music Review; **1045** M-F Sports Roundup.

RADIO AUSTRALIA

1000 D News; **1005** S Go Zone (pop music), M-F Asia Pacific (regional current affairs), A Australian Express (magazine); **1030** S Rural Reporter, M Health Report, T Law Report, W Religion Report, H Media Report, F The Sports Factor.

RADIO NETHERLANDS

1030 S/A News, M-F Newline; **1035** S Wide Angle (week in review), A Europe Unzipped; **1055** S The Week Ahead (program previews), A Insight (commentary).

RADIO NEW ZEALAND INTERNATIONAL

1000 D News; **1005** S Mediawatch, M-F Late Edition (the day's news), A Deep Purple (relaxing music/nostalgia); **1035** S Sunday Supplement.

VOICE OF AMERICA (News Now)

1000 D News and Reports; **1023** D Sports; **1030** D News Headlines; **1033** S-H Main Street (life in the US), F/A On the Line (US foreign policy); **1055** A Government Editorial.

KWHR, Hawaii

11565 kHz.: **1000** A DXing with Cumbre.

WWCR, Tennessee

5070 kHz.: **1000** A Left Behind; **1010** S A View from Europe.
15825 kHz.: **1015** S Ask WWCR (letters).

1100 UTC/ 7am E/4am P - Page 48 Freqs

BBC WORLD SERVICE (am)

1100 D World Briefing; **1105** M-F Caribbean Morning Report; **1110** M-F Sports Caribbean; **1115** M-F Caribbean Magazine; **1120** D British News; **1130** S Assignment, M-F World Business Report, A World Business Review; **1145** M-H, A Sports Roundup, F Football Extra.

BBC WORLD SERVICE (eas)

1100 S/A World Briefing, M-F News; **1105** M Health Matters, T Go Digital, W Discovery (science), H One Planet (ecology), F Science in Action; **1120** S/A British News; **1130** S Play of the Week, M Everywoman, T Omnibus (documentary), W Sports International, H/F Documentaries, A Analysis; **1145** A Sports Roundup.

HCJB, Ecuador

1100 S Let My People Think, M-F Insight for Living, A We Kids; **1128** M-F Money Minute; **1130** S Encounter, M-F Morning in the Mountains (Christian breakfast show w/News **1130**, Overcomers **1133**, Listen to the Bible **1140**, Beyond the Call **1145**), A Down Gilead Lane.

RADIO AUSTRALIA

1100 D News; **1105** S Correspondents' Report, M-A Asia Pacific (regional current affairs); **1130** S Business Report, M-F Regional Sports Report, A Fine Music Australia (classical); **1135** M-F Bush Telegraph (rural life).

RADIO JAPAN - NHK WORLD

1100 D News; **1110** S Hello from Tokyo (listener contact), A Pop Joins the World; **1115** M-F Asian Top News (headlines from region's radio); **1125** M Japan Music Log, T Let's Learn Japanese, W Japan Music Treasure Box, H Brush Up Your Japanese, F Music Beat.

RADIO KOREA INTERNATIONAL

1130 D News; **1140** S Korean Pop Interactive (requests), M-F News Commentary, A Friendship Unlimited (letters, DX news); **1145** M-F Seoul Calling (magazine).

RADIO NETHERLANDS

1100 S Aural Tapestry (culture), M EuroQuest (Europe in context), T A Good Life (development issues), W Dutch

Horizons, H Research File (science), F Documentary, A Amsterdam Forum (conversations); **1130** S Dutch Horizons, M Research File, T/A Music 52-15 (international music), W Documentary, H Aural Tapestry, F A Good Life.

RADIO NEW ZEALAND INTERNATIONAL

1100 D RNZ News; **1105** S/A Forces Radio (for NZ personnel serving in PNG & E. Timor), M-H Nine to Noon (current affairs), F Sports Story; **1130** F Top 5.

WWCR, Tennessee

5070 kHz.: **1100** S Profiles; **1105** A Rock the Universe (Christian rock music).
15825 kHz.: **1110** A A View from Europe.

1200 UTC/ 8am E/5am P - Page 48 Freqs

BBC WORLD SERVICE (am) - 6195, 15190

1200 D Newshour; **1205** M-F Caribbean Business; **1210** M-F Caribbean Morning Report; **1215** M-F Newshour (cont'd.).

BBC WORLD SERVICE (eas) - 6195, 9740, 15360

1200 S Play of the Week (cont'd. from 1130), M-A News; **1205** M-F Outlook (magazine), A Just a Minute (comedic panel game); **1230** S Assignment, A Pick of the World (BBC's best); **1245** M Write On (letters), T Heart and Soul (spiritual matters), W/F Westway (drama serial), H What's the Problem? (advice).

HCJB, Ecuador

1200 S Moody Presents, M-F Morning in the Mountains (cont'd. from 1130 w/News **1200** & **1230**, Insights **1205**, Sports **1206**, Mission Network News **1220**, Guidelines for Living **1233**), A Adventures in Odyssey; **1230** S The Living Word, A Toonz!

RADIO AUSTRALIA

1200 D News; **1205** S Nocturne (night music), M-H Late Night Live (discussion and interviews), F Sound Quality (innovative music), A The Spirit of Things (spiritual matters).

RADIO CANADA INTERNATIONAL

1200 M-F News; **1205** M-F The Current (current affairs-joined in progress).

RADIO KOREA INTERNATIONAL

1200 S Korean Pop Interactive (cont'd.), M Korea Today & Tomorrow, T Cultural Promenade, W Economic Radar, H Korea & Its Splendors, F Notes of Nostalgia (traditional music), A Friendship Unlimited (cont'd.).

RADIO NETHERLANDS

1200 S/A News, M-F Newline; **1205** S Sincerely Yours (letters), A Europe Unzipped.

RADIO NEW ZEALAND INTERNATIONAL

1200 S-F RNZ News, A Forces Radio (cont'd.); **1205** S Sportsworld (recap magazine), M-F Late Edition.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1200 S World of Radio, M Spiritual Awakening, T-A Freespeech Radio News (Pacifica Reporters Against Censorship daily newscast); **1230** S RFPI Mailbag, M World of Radio, T/H/A Hightower Radio (commentary), W Counterspin (media analysis), F This Way Out (lesbian/gay magazine); **1235** T/H/A Earthwatch (ecology); **1240** T/H/A Earth & Sky (astronomy); **1245** T Tropical Conservation Newsbureau (rainforests), H World Citizen's Weekly Commentary, A Women (UN program).

RADIO SWEDEN

1230 S In Touch with Stockholm (listener contact-1st)/ Sounds Nordic (rock music-exc. 1st), M-F Sixty Degrees North (regional report), A Network Europe (Europe magazine-1st week)/Sweden Today (2nd)/Spectrum (arts magazine-3rd)/Studio 49 (topical discussion-4th); **1245** M Sports Scan, T Close Up (profiles of Swedes-1st/3rd), H Nordic Report (1st)/Green Scan (ecology-2nd)/Heart Beat (health-3rd)/The S-Files (things Swedish-4th), F Review of the Newsweek.

Shortwave Guide



WHRI, Indiana

9840 kHz.: **1200** A DXing with Cumbre.
15105 kHz.: **1230** A DXing with Cumbre.

WWCR, Tennessee

5070 kHz.: **1205** S Rock the Universe (Christian rock music).
15825 kHz.: **1230** T Musical Memories.

1300 UTC/ 9am E/6am P - Page 49 Freqs

BBC WORLD SERVICE (am)

1300 D News; **1305** S Composer of the Month, M-F Outlook (magazine), A World Football; **1330** S In Praise of God, A The Music Feature; **1345** M-F Off the Shelf (book readings).

BBC WORLD SERVICE (eas)

1300 D Newshour; **1350** M-F World Business Report.

CHANNEL AFRICA, South Africa

1300 S/A Channel Africa Extra (weekend variety magazine).

CHINA RADIO INTERNATIONAL

1300 D News & Reports; **1310** S Report on Developing Countries; **1315** A Cutting Edge (sci/tech); **1320** S In the Spotlight (cultural magazine); **1330** M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

HCJB, Ecuador

1300 S Viewpoint, M-F Precept, A Toonz! (continued); **1313** M-F Getting the Message; **1315** M-F Proclaim!; **1330** S Mountain Meditations, M-F Family Life Today, A Studio 9 Weekend.

RADIO AUSTRALIA

1300 D News; **1305** S Nocturne (cont'd.), M-F The Planet (diverse music from around the world), A The Science Show.

RADIO CANADA INTERNATIONAL

1300 D News; **1305** S The Sunday Edition, M-F Sounds Like Canada (Canadian magazine including **1330** W C'est La Vie (life in French Canada)); A The House (Canadian politics).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1300 S Making Contact, M RadioNation ("The Nation" magazine), T Disability Radio Worldwide, W World of Radio, H A Public Affair, F Far Right Radio Review, A Continent of Media; **1330** S Alternative Radio (political/social analysis), T This Way Out (lesbian/gay magazine), W RFPI Mailbag, A World of Radio.

WWCR, Tennessee

15825 kHz.: **1300** M-F World Wide Country Radio (country music), **1330** S The Old Record Shop (vintage recordings).

RADIO SWEDEN

1330 S In Touch with Stockholm (listener contact-1st)/ Sounds Nordic (rock music-exc. 1st), M-F Sixty Degrees North (regional report), A Network Europe (Europe magazine-1st week)/Sweden Today (2nd)/Spectrum (arts magazine-3rd)/Studio 49 (topical discussion-4th); **1345** M Sports Scan, T Close Up (profiles of Swedes-1st/3rd), H Nordic Report (1st)/Green Scan (ecology-2nd)/Heart Beat (health-3rd)/The S-Files (things Swedish-4th), F Review of the Newsweek.

1400 UTC/ 10am E/7am P - Page 49 Freqs

BBC WORLD SERVICE (am)

1400 D News; **1405** S Talking Point (global phone-in), M Meridian-Masterpiece, T Meridian-Screen, W Meridian-Writing, H The Music Biz, F Arts in Action, A Sportsworld (live action); **1430** M Charlie Gillett (world music), T UK Top 20, W Revolver (musician's choice), H John Peel (eclectic), F Jazzmatazz.

BBC WORLD SERVICE (eas)

1400 S/A News, M-F East Asia Today; **1405** S Talking Point (global phone-in), A Sportsworld (live action); **1430** M-F British News; **1445** M-H Sports Roundup, F Football Extra.

CHANNEL AFRICA, South Africa

1400 S/A Channel Africa Extra (cont'd from 1300).

CHINA RADIO INTERNATIONAL

1400 D News & Reports; **1410** S Report on Developing Countries; **1415** A Cutting Edge (sci/tech); **1420** S In the Spotlight (cultural magazine); **1430** M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

HCJB, Ecuador

1400 S Renewing Your Mind, M-F Haven, A Studio 9 Weekend (continued).

RADIO AUSTRALIA

1400 D News; **1405** S Books & Writing, M-F Margaret Throsby (interview/music), A New Dimensions ("progressive" ideas).

RADIO CANADA INTERNATIONAL

1400 D News; **1405** S The Sunday Edition (cont'd.), M-F Sounds Like Canada (cont'd.), including **1405** M Workology (about working), **T-F** Out Front (first person views of life), A Vinyl Cafe.

RADIO JAPAN - NHK WORLD

1400 D News; **1410** S Pop Joins the World, A Weekend Square (Japanese life); **1415** M-F 44 Minutes (feature magazine).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1400 S Alternative Radio (cont'd.), M New Dimensions ("progressive" ideas), T University Forum (interviews), W Continent of Media, H WINGS (women's news), F Disability Radio Worldwide, A RFPI Mailbag; **1430** S Far Right Radio Review, T Honoring Mother Earth: Indigenous Voices, W A World of Possibilities, H Global Community Forum (interviews), F A Woman's Voice, A University Forum (interviews).

RADIO NETHERLANDS

1430 S/A News, M-F Newline; **1435** S Sincerely Yours (letters), A Europe Unzipped; **1455** S The Week Ahead (program previews), A Insight (commentary).

RADIO SWEDEN

1430 S In Touch with Stockholm (listener contact-1st)/ Sounds Nordic (rock music-exc. 1st), M-F Sixty Degrees North (regional report), A Network Europe (Europe magazine-1st week)/Sweden Today (2nd)/Spectrum (arts magazine-3rd)/Studio 49 (topical discussion-4th); **1445** M Sports Scan, T Close Up (profiles of Swedes-1st/3rd), H Nordic Report (1st)/Green Scan (ecology-2nd)/Heart Beat (health-3rd)/The S-Files (things Swedish-4th), F Review of the Newsweek.

1500 UTC/ 11am E/8am P - Page 50 Freqs

BBC WORLD SERVICE (am)

1500 D News; **1501** S Concert Hall; **1505** M One Planet (ecology), T Science in Action, W Health Matters, H Go Digital, F Discovery (science), A Sportsworld (live action); **1530** S People & Politics, M/T Documentaries, W Everywoman, H Omnibus (documentary), F Sports International.

BBC WORLD SERVICE (eas)

1500 D News; **1505** S Composer of the Month, M Meridian-Masterpiece, T Meridian-Screen, W Meridian-Writing, H The Music Biz, F Arts in Action, A Sportsworld (live action); **1530** S Global Business, M Charlie Gillett (world music), T UK Top 20, W Revolver (musician's choice), H John Peel (eclectic), F Jazzmatazz.

CHINA RADIO INTERNATIONAL

1500 D News & Reports; **1510** S Report on Developing

Countries; **1515** A Cutting Edge (sci/tech); **1520** S In the Spotlight (cultural magazine); **1530** M People in the Know (China's leading personalities), T Biz China, W China Horizons (China outside Beijing), H Voices from Other Lands, F Life in China, A Listeners' Garden.

RADIO AUSTRALIA

1500 D News; **1505** S Encounter (religion in Australia), M-F Asia Pacific (regional current affairs), A Nocturne (night music); **1530** M Health Report, T Law Report, W Religion Report, H Media Report, F The Sports Factor; **1555** S Business Weekend.

RADIO NETHERLANDS

1500 S Dutch Horizons, M Research File (science), T/A Music 52-15 (international music), W Documentary, H Aural Tapestry (culture), F A Good Life (development issues); **1530** S Aural Tapestry, M EuroQuest (Europe in context), T A Good Life, W Dutch Horizons, H Research File, F Documentary, A Amsterdam Forum (conversations).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1500 S Far Right Radio Review (cont'd.), M Voices of Our World (Maryknoll program), T Honoring Mother Earth: Indigenous Voices (cont'd), W Living Enrichment Center, H Global Community Forum (cont'd), F A Woman's Voice (cont'd), A A World of Possibilities; **1530** S World Citizens Weekly Commentary, M Perspective (UN program), T In the Moment, W Peace Forum, H Scope (UN program), F Tropical Conservation Newshour (rainforests), A Newmaier Report; **1545** S/M Hightower Report (commentary), T-A UN Today; **1548** S/M Earthwatch (ecology); **1551** S/M Earth & Sky (astronomy); **1555** S/M World Opinion (on terrorism).

WHRI, Indiana

13760 kHz.: **1500** A DXing with Cumbre.

WWCR, Tennessee

12160 kHz.: **1505** S America's Greatest Heroes.

1600 UTC/ 12pm E/9am P - Page 50 Freqs

BBC WORLD SERVICE (am)

1600 S/A News, M-F Europe Today; **1605** S Sportsworld (live action); **1630** M-F World Business Report; **1645** M-F Sports Roundup.

HCJB, Ecuador

1600 S Message of Truth, M-F Renewing Your Mind, A Words of Hope.

RADIO AUSTRALIA

1600 D News; **1605** S The National Interest (Australian politics), M-F Bush Telegraph (rural/outback Australia), A Nocturne (cont'd.).

RADIO CANADA INTERNATIONAL

1600 S/A News; **1605** S The Sunday Edition (cont'd.), A Quirks and Quarks (science).

RADIO NETHERLANDS

1600 S/A News, M-F Newline; **1605** S Wide Angle (one issue focus), A Europe Unzipped.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1600 S A Public Affair, M-F Democracy Now!, A CounterSpin (media analysis); **1630** A Freespeech Radio News (repeat of Fri. newscast).

VOICE OF AMERICA, Africa Service

1600 S/A Nightline Africa (weekend newsmagazine), M-F News & Reports; **1615** M-F Focus (a topic in-depth); **1623** M-F Sports; **1630** M-F Africa World Tonight.

RADIO OSTERREICH INTERNATIONAL

1630 S Letter from Austria, M-F Report from Austria (magazine), A Insight Central Europe; **1635** S Network Europe; **1650** A Postbox.

KWHR, Hawaii

9930 kHz.: **1600** A DXing with Cumbre.

Shortwave Guide



WWCR, Tennessee

12160 kHz.: **1630** A Ken's Country Classics (country music).

1700 UTC/ 1pm E/10am P - Page 51 Freqs

CHANNEL AFRICA, South Africa

1700 S Network Africa (week in review), M-F Dateline Africa (news magazine), A Channel Africa Sport.

RADIO AUSTRALIA

1700 D News; **1705** S The Spirit of Things (spiritual matters), M-F Australia Talks Back (phone-in), A New Dimensions ("progressive" ideas).

RADIO JAPAN - NHK WORLD

1700 D News; **1710** S Pop Joins the World, A Hello from Tokyo (listener contact); **1715** M-F 44 Minutes (feature magazine).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1700 S Neumaier Report, M Between the Lines, T A Woman's Voice, W Alternative Radio, H Making Contact, F Honoring Mother Earth: Indigenous Voices, A TUC Radio; **1715** S Living Enrichment Center; **1730** M TUC Radio, H Steppin' Out of Babylon, A Continent of Media.

VOICE OF AMERICA, Africa Service

1700 S Reporters' Roundtable, M-A News; **1706** M-F Talk to America (global phone-in), A Best of Talk to America; **1730** S Music Time in Africa; **1755** A Government Editorial.

VOICE OF GREECE

1700 A All Greek to Me (Greek popular & traditional music)

SWISS RADIO INT.

1730 S/A Swiss Scene, M-F Newsnet; **1735** A Take 2; **1740** S Culture Zone (the arts-1st/3rd wk) or Out and About (Swiss places-2nd/4th wk), A Sounds Good (Swiss music-3rd/5th wk); **1745** F Business Spotlight.

ALL INDIA RADIO

1745 M Light Music, T Karnatak Instrumental Music, W Folk Songs, H-S Devotional Music.

WWCR, Tennessee

12160 kHz.: **1715** W Ask WWCR (exc. 2nd/3rd W). 15825 kHz.: **1730** S Ask WWCR, T Dialogue.

1800 UTC/ 2pm E/11am P - Page 51 Freqs

ALL INDIA RADIO

1800 D News; **1810** D Commentary; **1815** W Instrumental Music—Old Masters, H-T Hindustani Classical Vocal Music; **1830** S Sports Roundup (1st wk)/Feature (2nd)/Film Story (3rd)/Discussion (4th), M Faithfully Yours (letters), T Cultural Talk, W Book Review (1st)/Window on Science (2nd/4th)/Times & Lives (biography-3rd), H General Talk, F Focus (magazine-1st)/Horizon (literature-2nd/4th)/Music (3rd), A For Youth (1st)/Indian Classics (books-2nd)/From the Archives (3rd)/Quiz Time (4th); **1840** M DXers Corner (2nd/4th), T Film Songs of Yesteryears, W Hits from Films, H Light Karnatak Music, F Light Instrumental Music; **1850** M Film Songs, F Light Music.

CHANNEL AFRICA, South Africa

1800 S Network Africa (week in review), M-F Dateline Africa (news magazine), A Channel Africa Sport.

RADIO AUSTRALIA

1800 D News; **1805** S-H Pacific Beat (Pacific islands magazine), F Pacific Review, A Lifelong Learning; **1830** F Educational series.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1800 S Spiritual Awakening, M Steppin' Out of Babylon, T RadioNation (OThe Nation' magazine), W Voices of Our World (Maryknoll program), H Between the Lines, F WINGS (women's news), A World of Radio; **1830** S

World of Radio, M/W/F Hightower Radio (commentary), T Counterspin (media analysis), H This Way Out (lesbian/gay magazine), A RFPI Mailbag; **1835** M/W/F Earthwatch (ecology); **1840** M/W/F Earth & Sky (astronomy); **1845** M Tropical Conservation Newsbureau (rainforests), W World Citizen's Weekly Commentary, F Women (UN program).

RTE, Ireland

1830 S Saturday View, M This Week with Gerald Barry, T-A 5-7 Live (top news of the day).

VOICE OF AMERICA, Africa Service

1800 S/A News & Reports, M-F Africa World Tonight; **1823** S/A Sports; **1830** S/A News Headlines, W Straight Talk Africa (continental phone-in); **1833** S/A On the Line (US foreign policy); **1855** S/A Government Editorial.

WHRI, Indiana

13760 kHz.: **1800** A DXing with Cumbre.

WWCR, Tennessee

12160 kHz.: **1800** A Musical Memories.

1900 UTC/ 3pm E/12pm P - Page 52 Freqs

ALL INDIA RADIO

1900 D News; **1905** D Press Review; **1910** S Women's World, M/W/F Radio Newsreel, T Of Persons, Places & Things (1st/3rd wk)/Our Guest (interviews-2nd/4th), H Panorama of Progress, A Mainly for Tourists (1st/3rd)/Indian Cinema (2nd)/On the Export Front (4th); **1920** S/M/W/F Film Songs, T Light Classical Music, H Light Instrumental Music, A Karnatak Classical Music; **1930** D Commentary; **1935** S/H/F Film Songs, M Karnatak Vocal Music, T Folk Songs, W/A Light Music.

RADIO AUSTRALIA

1900 D News; **1905** S-H Pacific Beat (cont'd.), F Pacific Focus (health), A Australia All Over (w/news 1930); **1930** F In Conversation (on science).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

1900 S RadioNation ("The Nation" magazine), M Disability Radio Worldwide, T World of Radio, W A Public Affair, H Far Right Radio Review, F Continent of Media, A Making Contact; **1930** M This Way Out (lesbian/gay magazine), T RFPI Mailbag, F World of Radio, A Alternative Radio (political/social analysis).

VOICE OF AMERICA, Africa Service

1900 S News & Reports, M-F News, A Hip Hop Connections (music); **1906** M-F Border Crossings (music—exc. W Straight Talk Africa cont'd.); **1923** S Sports; **1930** S Music Time in Africa (part 2), M-F World of Music, A News Headlines; **1933** A Our World (ecology, science & technology).

VOICE OF NIGERIA

1900 S Youth Forum, M Our Cities, T Our Environment, W Who Are the Nigerians?, H Listeners' Letters, F Nigerian Scene, A Folktales; **1915** H Wheel of Progress, F Business Weekly, A Nigerian Newsletter; **1930** S Window on Abuja, M Perspectives, T African Monarchy, W Theatre on the Air, H Women and Development, F Weekend Magazine, A Time for Highlife; **1945** S From the Bookshelf, T Listeners' Letters.

SWISS RADIO INT.

1930 S/A Swiss Scene, M-F Newsnet; **1935** A Take 2; **1740** S Culture Zone (the arts-1st/3rd wk) or Out and About (Swiss places-2nd/4th wk), A Sounds Good (Swiss music-3rd/5th wk); **1945** F Business Spotlight.

WHRI, Indiana

9495 kHz.: **1930** A DXing with Cumbre.

WWCR, Tennessee

12160 kHz.: **1900** A World Wide Country Radio (country music).

2000 UTC/ 4pm E/1pm P - Page 52 Freqs

RADIO AUSTRALIA

2000 D News; **2005** S-H Pacific Beat (cont'd.), F Pacific Review, A Australia All Over (cont'd); **2030** F Country Breakfast (rural issues).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

2000 S New Dimensions ("progressive" ideas), M University Forum (interviews), T Continent of Media, W WINGS (women's news), H Disability Radio Worldwide, F RFPI Mailbag, A Alternative Radio (cont'd); **2030** M Honoring Mother Earth: Indigenous Voices, T A World of Possibilities, W Global Community Forum (interviews), H A Woman's Voice, F University Forum (interviews), A Far Right Radio Review.

SWISS RADIO INT.

2000 S/A Swiss Scene, M-F Newsnet; **2005** A Take 2; **1740** S Culture Zone (the arts-1st/3rd wk) or Out and About (Swiss places-2nd/4th wk), A Sounds Good (Swiss music-3rd/5th wk); **2015** F Business Spotlight.

VOICE OF NIGERIA

2000 S News Bulletin, M-F Sixty Minutes, A African Hour; **2015** S Sports Roundup; **2030** S In the News.

VOICE OF AMERICA, Africa Service

2000 S/A Nightline Africa (weekend magazine), M-F Africa World Tonight.

ALL INDIA RADIO

2045 D Press Review; **2050** S/T Instrumental Music, M/F Folk Songs, W Light Music, H Classical Indian Vocal Music, A Regional Indian Devotional Music.

WBCQ, Maine

7415 kHz.: **2000** H-S Radio Caroline (the original Europirate radio station).

WWCR, Tennessee

15825 kHz.: **2030** T Left Behind, H World of Radio, F Ask WWCR, A Presidential Radio Address/Democratic Response.

2100 UTC/ 5pm E/2pm P - Page 53 Freqs

ALL INDIA RADIO

2100 D News; **2105** D Commentary; **2111** S Regional Film Songs, M/A Classical Indian Vocal Music, T Karnatak Vocal Music, W/H Instrumental Music, F Orchestral Music; **2120** S Sports Roundup (1st wk)/Feature (2nd)/Film Story (3rd)/Discussion (4th), M Faithfully Yours (letters), T Cultural Talk, W Radio Newsreel, H Panorama of Progress, F Focus (magazine-1st wk)/Horizon (literature-2nd/4th)/Indian Music (3rd), For Youth (1st)/Indian Classics (books-2nd)/From the Archives (3rd)/Quiz Time (4th); **2130** M DXers Corner (2nd/4th), T/W Film Songs, H Classical Half-Hour, A Old Film Songs; **2140** F Film Songs; **2145** M Film Songs; **2150** S Karnatak Vocal Music.

BBC WORLD SERVICE (am)

2100 D News; **2105** S Global Business, M-F World Business Report, A World Business Review; **2115** M-F Caribbean Report; **2120** A British News; **2130** D Sports Roundup; **2145** S Reporting Religion, M/T/H/F Analysis, W From Our Own Correspondent, A Letter from America.

[Special service to the Caribbean on 5975, 11675, 15390 kHz.: **2105** M-F Caribbean Report. Special service to the Falklands on 11680 kHz.: **2130** T/F Calling the Falklands.]

RADIO AUSTRALIA

2100 D News; **2105** F Feedback (letters, station news, on communications), A Australia All Over (cont'd); **2110** S-H AM (morning news magazine); **2130** S Educational series, M Health Report, T Innovations (new products), W Religion Report, H Rural Reporter, F Oz Sounds (new music releases).

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RADIO JAPAN - NHK WORLD

2100 D News; **2110** S Pop Joins the World, A Weekend Square; **2115** M-F Asian Top News (headlines from region's radio); **2125** M Japan Music Log, T Let's Learn Japanese, W Japan Musical Treasure Box, H Brush Up Your Japanese, F Music Beat.

RADIO FOR PEACE INTERNATIONAL, Costa Rica

2100 S Voices of Our World (Maryknoll program), M Honoring Mother Earth: Indigenous Voices (cont'd), T Living Enrichment Center, W Global Community Forum (cont'd), H A Woman's Voice (cont'd), F A World of Possibilities, A Far Right Radio Review (cont'd); **2130** S Perspective (UN program), M In the Moment, T Peace Forum, W Scope (UN program), H Tropical Conservation Newshour (rainforests), F Newmaier Report, A World Citizens Weekly Commentary; **2145** S/A Hightower Report (commentary), M-F UN Today; **2148** S/A Earthwatch (ecology); **2151** S/A Earth & Sky (astronomy); **2155** S/A World Opinion (on terrorism).

RADIO PRAGUE

2100 D News; **2105** S Letter from Prague, M-F Current Affairs, A Readings from Czech Literature; **2110** S The Arts, A Saturday Music (classical/folk/jazz); **2115** S Mailbox, M Spotlight (Czech current events) or One on One (interview), W Czechs in History or Central Europe Today, F Magazine; **2120** T Talking Point, H Economic Report.

VOICE OF AMERICA, Africa Service

2100 D News; **2106** S/A Jazz America, M American Gold, T Roots and Branches, W Classic Rock, H Top 20, F Country Hits.

WBCQ, Maine

7415 kHz.: **2100** S Radio Free Euphoria, M Jean Shepherd, F Pan Global Wireless, A HarvZower; **2130** F Pab Sungenis Project.

WHRI, Indiana

5745 kHz.: **2100** S DXing with Cumbre.

WHRA, Maine

17650 kHz.: **2100** F DXing with Cumbre; **2130** A DXing with Cumbre.

2200 UTC/ 6pm E/3pm P - Page 54 Freqs

ALL INDIA RADIO

2200 D News; **2210** D Commentary; **2215** S Women's World, M/F Radio Newsreel, T Of Persons, Places & Things (1st/3rd wk)/Our Guest (interview-2nd/4th), W Book Review (1st)/Window on Science (2nd/4th)/Times & Lives (biography-3rd), H General Talk, A Mainly for Tourists (1st/3rd)/Indian Cinema (2nd)/On the Export Front (4th); **2225** D Film Tune.

BBC WORLD SERVICE (am)

2200 D The World Today; **2230** S Agenda (trends), F People and Politics, A From Our Own Correspondent.

RADIO AUSTRALIA

2200 D News; **2205** F Asia Pacific (regional current affairs), A Correspondents' Report; **2210** S-H AM (morning news magazine); **2230** F AM (morning news magazine), A Business Report; **2240** S Australian Music Show (rock), M Music Deli (international), T Blacktracker (Aboriginal contemporary music), W Country Style, H Jazz Notes.

RADIO CANADA INTERNATIONAL

2200 S/A The World This Weekend, M-F The World at 6; **2230** S Inside Track (sports anthologies) M-F As It Happens (interviews with newsmakers), A Madly Off in All Directions (comedy).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

2200 S A Public Affair, M-F Democracy Now!, A CounterSpin (media analysis); **2230** A Freespeech Radio News (repeat of Fri. newscast).

RADIO PRAGUE

2230 D News; **2235** S Letter from Prague, M-F Newview,

A Insight Central Europe; **2240** S Mailbox, M One on One (interview), T Witness (oral history), W ABC of Czech (language), H Economic Report, F The Arts; **2250** S Readings from Czech Literature, T Talking Point (Czech issues), W Czechs in History or Spotlight (travelogue), F Away from Politics (poetry).

RVi, Belgium

2230 S Radio World, M-F News, A Music from Flanders; **2234** M-F Flanders Today (incl.press review); **2238** S Tourism in Flanders; **2243** M Focus on Europe, T Green Society (ecology), W/F Around the Arts, H Economics; **2244** S Brussels 1043 (letters); **2248** M Sports, W Around Town, H International Report, F Tourism in Flanders; **2254** S-F Soundbox (Flemish music).

VOICE OF TURKEY

2200 D News; **2210** D Press History; **2215** S Tunes Spanning Centuries, M Last Week, T Live From Turkey, W Review of the Foreign Media, H Big Powers & the Armenian Problem, F Archaeological Settlements in Turkey, A Outlook; **2220** M Hues & Colors of Anatolia, W Letterbox, A The Stream of Love or DX Corner; **2225** S/F Music, H In the Wake of a Contest; **2230** M/A Music; **2235** S Turks in the Mirror of Centuries, M From Past to Present, W Turkey's Off the Beaten Track Sites, H The Culture Parade, F The Travel Itinerary of Anatolia, A Turkish Arts.

WBCQ, Maine

7415 kHz.: **2200** W World of Radio, F Pab Sungenis Project (cont'd), A Radio Timtron Worldwide; **2230** W Goddess Irina I Music Show, H Uncle Ed's Musical Memories, F WDCD.

WHRI, Indiana

9495 kHz.: **2230** A DXing with Cumbre.

2300 UTC/ 7pm E/4pm P - Page 54 Freqs

BBC WORLD SERVICE (am)

2300 S World Briefing, M-A News; **2301** A Play of the Week (drama); **2305** M-F Outlook (magazine) **2320** S Sports Roundup; **2330** S The World Today; **2345** M Write On, T Heart & Soul (spiritual matters), W/F Westway (drama serial), H What's the Problem? (advice).

CHINA RADIO INTERNATIONAL

0100 D News & Reports; **0110** A Report on Developing Countries; **0115** F Cutting Edge (sci/tech); **0120** A In the Spotlight (cultural magazine); **0130** S People in the Know (China's leading personalities), M Biz China, T China Horizons (China outside Beijing), W Voices from Other Lands, H Life in China, F Listeners' Garden.

RADIO AUSTRALIA

2300 D News; **2305** F Lingua Franca (about language), A All in the Mind; **2310** S-H Asia Pacific (regional current affairs); **2330** S Earthbeat (ecology), M The Buzz (technology issues), T RA Arts, W Rural Reporter, H Media Report, F In Conversation (on science), A Innovations (new products).

RADIO BULGARIA

2300 D News; **2310** A Views Behind the News, S Folk Studio (Bulgarian folk music), M-F Events and Developments (current affairs review); **2320** M Sports; **2325** M-F Timeout for Music; **2330** F Bulgarian Plaza (cultural magazine) or Walks and Talks (interesting places); **2335** M-F Keyword Bulgaria (Bulgaria and things Bulgarian), H Answering Your Letters; **2345** M Magazine Economy, T Arts and Artists; W History Club, H The Way We Live, F Radio Bulgaria Calling (for radio hobbyists).

RADIO CANADA INTERNATIONAL

2300 D CBC News; **2305** A Quirks & Quarks (science), S Global Village (world music), M-F As It Happens (interviews with newsmakers)[began at 2230]; **2330** W Dispatches (world events in Canadian perspective).

RADIO NETHERLANDS

2330 S/A News; M-F Newline; **2335** S Sincerely Yours

(letters), A Europe Unzipped; **2355** S The Week Ahead (program previews), A Insight (commentary).

RADIO NEW ZEALAND INTERNATIONAL

2300 S-H World and Pacific News, F/A RNZ News; **2310** S-H Sports News, F Saturday with Kim Hill, A Feature or series; **2315** S-H Pacific Weather; **2317** S-H Nine to Noon (topical magazine).

RADIO FOR PEACE INTERNATIONAL, Costa Rica

2300 S Neumaier Report, M Between the Lines, T A Woman's Voice, W Alternative Radio, H Making Contact, F Honoring Mother Earth: Indigenous Voices, A TUC Radio; **2315** S Living Enrichment Center; **2330** M TUC Radio, H Steppin' Out of Babylon, A Continent of Media.

RADIO ROMANIA INTERNATIONAL

2300 D Radio Newsreel; **2310** S Focus, M-F Commentary, A The Week; **2315** S Sunday Studio, M Pro Memoria (history), T Business Club, W Society Today, H Cards on the Table (debate) or The Romanian Next to You (interview), F Challenge for the Future or Terra 2001, A World of Culture; **2320** M Political Flash, T European Horizons, A RRI Encyclopedia; **2325** S Romanian by Radio, M/W/F Business Update, T Tourist News, H Listeners' Letterbox, A Roots (culture/traditions); **2330** S Romanian Itineraries, M Pulse of Transition, T Mother Nature (ecology), W Visit Romania, F Practical Guide, A Radio Pictures; **2335** S Listeners' Letterbox, M Performing Arts, T Youth Club, W Partners in a Changing World, F Cultural Survey, A Romanian Itineraries; **2340** M Pages of Romanian Literature, T/H Skylark (folk music), W Stage and Screen, F Spectator (voice of the people), A Bucharest Along the Centuries; **2345** M Romanian Hits, W Romanian Musicians, F Romanian Folk Music At Its Best, A DX Mailbag; **2350** S Romanian Folk Music At Its Best, M Sports Roundup, T Athlete of the Week, W Sports Club, H Football Flash, F Sports Weekend.

WBCQ, Maine

7415 kHz.: **2300** S Le Show (humor/entertainment), W Off the Hook (public telecommunications issues), H Uncle Ed's Musical Memories (cont'd from 2230), F The Lost Discs Radio Show, A The Real Amateur Radio Show; **2330** W World of Radio, H Steppin' Out of Babylon, A Fred Flintstone Music Show.

WWCR, Tennessee

5070 kHz.: **2305** W The Bible's Greatest Heroes. 9475 kHz.: **2345** A Ask WWCR.

Thank You ...

Additional Contributors to This Month's Shortwave Guide:

Harold Frodge, Midland, MI; Glenn Hauser, Enid, OK; Bob Thomas, Bridgeport, CT; Harold Sellers, *BBC On Air*; *BCL News*; *BCDXC*; *Cumbre DX*; *DXA*; *DX Listening Digest*; *DX News*; *ODXA/DX Ontario*; *Fineware*; *Hard Core DX*; *HFCC*; *ILG*; *NASWA*; *NASWA Flash Sheet*; *World of Radio*; *Worldwide DX Club*.

Monitoring the U.S. Army Aviation on HF

When I think about monitoring U.S. Army communications I always relate their communications capability to networks in the VHF-low bands (30-50 MHz). I visualize long VHF whip antennas on jeeps and tanks and about the only communications networks on HF involve backup long-haul circuits or contingency networks.

But thanks to the PC ALE software program by Charlie Brain, my view of Army HF communications is slowly changing. HF has become a hotbed for U.S. Army communications, especially within the aviation community. Using PC ALE we have uncovered a large number of previously undiscovered Army HF ALE radio networks. In this month's edition of *Milcom* we will take a look at some of the Army Aviation HF networks that have been identified. This list is not complete and much work still needs to be done. Additions and corrections are welcomed.

If you are looking for a good frequency to park on as a possible benchmark for activity, try 6911.5 kHz. It is used by several of the Army nets we profile below. The bulk of the Army aviation activity appears to center around the 18th Airborne Corps, the 101st Airborne, and subordinate units.

◆ 18th Airborne Corps/44th Medcom

The mission the XVIII Airborne Corps is to maintain a strategic crisis response force, manned and trained to deploy rapidly by air, sea, and land anywhere in the world. Located at Fort Bragg, NC, it appears that they have their own HF Command ALE network. The frequencies for this net are 2221.5 3238.5 4021.5 4641.5 6911.5 7361.5 8171.5 9295.0 10680.0 11574.0 12168.0 kHz.

The tentative ALE address identifications for the 18th Airborne Corps are as follows:

L18	Logistics
P18	Personnel
T18	Training

The medical support for the 18th Airborne Corps rests with the 44th Medical Command, Fort Bragg, NC. At least two HF networks have been uncovered – voice/ALE.

The 44th Medical Brigade, call sign Strike 01, has been monitored on the following frequencies: 6997.5 13996.0 14488.5 14665.0 kHz. ALE activity from the 44th Medcom has been monitored on 5126.0 7360.0 9145.0

10161.5 11446.5 14395.0 kHz.

ALE Addresses:

44B1	44 th Medical Brigade, Fort Bragg, NC (Voice call sign: Fort Bragg 1)
44B2	44 th Medical Brigade, Fort Bragg, NC (Voice call sign: Fort Bragg 2)
44MED	44 th Medical Brigade, Fort Bragg, NC
520TAML	520 th Theater Army Medical Lab, Aberdeen Proving Grounds, MD
6TMMMC	6 th Theater Medical Material Management Center, Fort Dietrick, MD
ASM1	261 st Area Support Medical Battalion
HFB1	Unknown 1 st Battalion
HFB2	Unknown 2 nd Battalion

Non-44 Medical Command units noted in this net:

3MCI	3 rd Medcom Reserve Unit Decatur, GA (Voice call sign: 3rd Medcom)
14FH	14 th Field Hospital, Fort Bragg, NC
62MED	62 nd Medical Group, Fort Lewis, WA

◆ 101st Airborne, Fort Campbell, Kentucky

The 101st Airborne is a subordinate command of the 18th Airborne Corps. The 101st Airborne Division (Air Assault) at Fort Campbell, Kentucky, is capable of delivering a 4,000 soldier combined arms task force, 150-kilometers into enemy terrain in one lift; it possesses 281 helicopters, including three battalions of Apache attack helicopters. The Division is formed of three brigades plus Division Artillery, Division Support Command, the 101st Aviation Brigade, 159th Aviation Brigade, 101st Corps Support Group and several separate commands.

Frequencies:

3278.5 4032.5 4446.5 4520.0 4521.5 5129.0 5233.5 5399.0 5875.0 6911.5 6985.0 7361.5 7650.0 7718.5 7817.0 8171.5 8181.5 9081.5 9124.0 9295.0 10151.5



AH-64 Apache attack helicopters in Afghanistan Jan. 25. US Army Photo

10235.0 10670.5 10818.0 11170.5 11439.5 11550.0 11630.0 12129.0 12168.0 14483.5 20635.0 kHz

Note: there might be several subnets in the frequencies listed above and further intercepts/study will be required to ferret out these subnets.

ALE Addresses noted on the frequencies above:

101AVGRD	101 st Airborne Unit
101AVTOC	101 st Airborne Unit Tactical Operations Center
A101	101 st Airborne Unit
T101	101 st Airborne Unit
P159	159 th Aviation Brigade (Assault) Eagle Thunder
T159	159 th Aviation Brigade (Assault) Eagle Thunder
BDE	HHC 1 st BDE, 1 st Brigade, 101 st Airborne Division, 327 Infantry Brigade
B2ZB2	Unknown station
P2ZB2	Unknown station
T2ZB2	Unknown station
T2Z101	2-101 AVN - 2 nd Regiment, 101 st Airborne Eagle Warriors
L4Z101	4-101 AVN - 4 th Regiment, 101 st Airborne Wings of the Eagle
P4Z101	4-101 AVN - 4 th Regiment, 101 st Airborne Wings of the Eagle
P5Z101	5-101 AVN - 5 th Regiment, 101 st Airborne Eagle Assault
R5Z101	5-101 AVN - 5 th Regiment, 101 st Airborne Eagle Assault
T5Z101	5-101 AVN - 5 th Regiment, 101 st Airborne Eagle Assault
B7Z101	7-101 AVN - 7 th Regiment, 101 st Airborne Eagle Lift
P7Z101	7-101 AVN - 7 th Regiment, 101 st Airborne Eagle Lift
T7Z101	7-101 AVN - 7 th Regiment, 101 st Airborne Eagle Lift
T9Z101	9-101 AVN - 9 th Regiment, 101 st Airborne Eagle Strike
L1Z159	159 th Aviation Brigade Unit (Assault) Eagle Thunder
TZB159	159 th Aviation Brigade Unit (Assault) Eagle Thunder
R26299	Aircraft
R26420	Aircraft
R26445	Aircraft
R26446	Aircraft
R26492	Aircraft
I23	Unknown 159 th Aviation Brigade unit
1BN	Possible 101 st Airborne Unit
1C2	Possible 101 st Airborne Unit
FAN	Possible 101 st Airborne Unit
BASTOGNE	1 st Brigade, 101 st Airborne Division, 327 Infantry Brigade Bastogne
BFORCESCT	3-327 IN - 1 st Brigade, 101 st Airborne Division, 327 Brigade Voice Call: Lightning 6 Romeo
BFORCETOC	3-327 IN - 1 st Brigade, 101 st Airborne Division, 327 Brigade Tactical Operations Center Voice Call: Battleforce 28
DESTINY	101 st Aviation Brigade
EAGLEASSAULT	159 th Aviation Brigade (Assault) Eagle Thunder unit
EAGLEJCP	101 st Airborne (Attack) or 159 th Aviation Brigade

EAGLEMAIN (Assault) Eagle Thunder unit
101st Airborne (Attack) or 159th Aviation Brigade
(Assault) Eagle Thunder unit
EAGLENET 101st Airborne (Attack) or 159th Aviation Brigade
(Assault) Eagle Thunder unit
EAGLEREAR 101st Airborne (Attack) or 159th Aviation Brigade
(Assault) Eagle Thunder unit
EAGLEVOICE 101st Airborne (Attack) or 159th Aviation Brigade
(Assault) Eagle Thunder unit
EGLNST 101st Airborne or 159th Aviation Brigade (Assault) Eagle Thunder unit
GLORY 159th Aviation Brigade (Assault) Eagle Thunder unit
REDSIL Unknown ground station
SABRE 101st Airborne (Attack) Sabre AAF, KY
THUNDER 159th Aviation Brigade (Assault) Eagle Thunder

❖ Dust Off HF ALE Net

A possible 101st Airborne subnet is what I call the Dust Off net. This might be an aeromedical evacuation network.

Frequencies include:

4012.0 4018.5 4886.5 4923.0 5815.0 5851.5 6911.5
7650.0 8161.5 8184.5 9124.0 10530.0 10670.5
10799.0 10818.0 11439.5 12196.0 kHz.

ALE Addresses:

DUST Ground Station (possible Aeromedical Evacuation unit)
Voice Call: Guard Ops
T2Z25 Unknown station
L2Z4 Unknown station
T2Z4 Unknown station
T4Z3 Unknown station
T4Z4 Unknown station
R23890 Aircraft Voice Call 890
R24388 Aircraft
R26804 Aircraft

❖ 160th SOAR Network

An interesting U.S. Army net involves special operations forces from the 160th Special Operations Air Regiment (SOAR). The 160th Special Operations Aviation Regiment (Airborne) provides aviation support to Army special operations forces. The Regiment consists of MH-6 and AH-6 light helicopters, MH-60 helicopters, and MH-47 heavy assault helicopters. You can find more detailed information on the 160th SOAR at the following military website: <http://www.soc.mil/pao/factsht/160SOAR/160SOAR1.htm>.

There are at least 10 HF frequencies currently associated with this net which includes ground stations at Fort Campbell, Kentucky; Hunter AAF, Georgia; and Fort Rucker, Alabama.

Net frequencies discovered thus far:

4518.5 4721.0 5126.0 5881.5 8056.0 9121.0 9145.0
12068.5 16078.5 17458.5 kHz

Ground Station ALE Addresses:

75B Unknown type station, unknown location
756 Unknown type station, unknown location
831 Unknown type station, unknown location
842 Unknown type station, unknown location
ANY Ground station, unknown location
APACHE Ground station, unknown location
BGAD Blue Grass Army Depot, KY

CGR Ground station, unknown location
CGRAND Ground station, unknown location
CLH Hunter AAF, GA
CLS Fort Campbell, KY
CLX123 Unknown type station, unknown location
CPR Ground station, unknown location
CTC Ground station, unknown location
D24 Unknown type station, unknown location
DK1 Ground station, unknown location (Voice call Wild Base)
DKB Ground station, unknown location
F08001 Unknown type station, unknown location
FMORA Ground station, unknown location
GRB Fort Rucker AAF, AL (Voice call Ghost Rider Base)
HAF Ground station, unknown location (Voice call Night Stalker Ops)
HOCOP Unid Ground Station
HTR Ft. Campbell, KY (Voice call Hoot Ops)
IRNHWC Ground station, Unknown location (Voice ID: FCD, FTD or SCD Ironhawk? Called what sounded like Epps Field — CLS)
J8H290 Unknown type station, unknown location
JRTCTOC Fort Polk, LA (Joint Readiness Training Center) Tactical Operations Center
L26 Unknown type station, unknown location
MAURADERS Ground station, unknown location
MOC Ground station, unknown location
MOCHE MO Ground station, unknown location
NSB Ground station, unknown location
NSO Ground Station, Unknown location (Voice call Night Stalker Ops)
O26 Unknown type station, unknown location
R13 Unknown type station, unknown location
R14 Unknown type station, unknown location
R15 Unknown type station, unknown location
R25 Unknown type station, unknown location
R64 Unknown type station, unknown location
TOC Unidentified Tactical Operations Center

Aircraft ALE Addresses

Unidentified Aircraft
812363 Unid aircraft
814368 Unid aircraft
814372 Unid aircraft (Voice call Yahoo 93)
814375 Unid aircraft (Voice call 375)
814376 Unid aircraft
814378 Unid aircraft
814379 Unid aircraft (Voice call 379)
814380 Unid aircraft (Voice call 380)
823471 Unid aircraft
823473 Unid aircraft (Voice call Wild 41)
823477 Unid aircraft
831131 Unid aircraft
831161 Unid aircraft
831367 Unid aircraft



The Black Hawk is the Army's primary helicopter for air assault, general support, and aeromedical evacuation units. US Army Photo

832367 Unid aircraft (Voice call Shadow 21)
854194 Unid aircraft

MH-47 Chinook Fact Sheet:

<http://www.soc.mil/pao/factsht/160SOAR/Chinook1.htm>

D00131 Unid aircraft
D00146 Unid aircraft
D23763 Unid aircraft
D24118 MH-47D 3-160 SOAR Hunter AAF, GA
D24342 MH-47D 3-160 SOAR Hunter AAF, GA
D24360 MH-47D 3-160 SOAR Hunter AAF, GA
D24361 MH-47D 3-160 SOAR Hunter AAF, GA
D24367 MH-47D 3-160 SOAR Hunter AAF, GA
E00477 MH-47E 2-160 SOAR Fort Campbell, KY
E20471 MH-47E 2-160 SOAR Fort Campbell, KY
E20474 MH-47E 2-160 SOAR Fort Campbell, KY
E80267 MH-47E 2-160 SOAR Fort Campbell, KY

MH-60 Black Hawk Fact Sheet:

<http://www.soc.mil/pao/factsht/160SOAR/Bkhwk.htm>

K26368 MH-60K aircraft
K26375 MH-60K aircraft
K26378 MH-60K aircraft
L26184 MH-60L aircraft
L26185 MH-60L aircraft
L26186 MH-60L aircraft
L26189 MH-60L aircraft
L26289 MH-60L aircraft
L26290 MH-60L aircraft
L26350 MH-60L 3-160 SOAR Hunter AAF, GA
L26363 MH-60L aircraft
L26365 MH-60L 3-160 SOAR Hunter AAF, GA
L26366 MH-60L 3-160 SOAR Hunter AAF, GA
L26411 MH-60L 3-160 SOAR Hunter AAF, GA
L26417 MH-60L 1-160 SOAR Fort Campbell, KY
L26418 MH-60L 1-160 SOAR Fort Campbell, KY
L26419 MH-60L 1-160 SOAR Fort Campbell, KY
L26457 UH-60L aircraft?

❖ Other U.S. Army Aviation Units

There are several other U.S. Army aviation units that have a presence in the HF spectrum. Here is a brief summary of those units.

131st Aviation Battalion

Frequencies: 4780.0 6360.0 7360.0 kHz

ALE Addresses:

R00106 Aircraft
R00280 Aircraft Voice Call: 280
R00286 Aircraft
R00293 Aircraft Voice Call: 473
TEZ131 Ground Station

223rd Aviation Regiment

Frequencies: 6911.5 7361.5 9295.0 10818.0 kHz

ALE Addresses:

1B223 1-223 AVN - 1st Brigade, 223 Aviation Regiment
Fort Rucker, AL

224th Aviation Regiment

Frequencies: 8037.0 9119.5 kHz

ALE Addresses:

F2Z224 2-224 AVN - 2nd Battalion, 224 Aviation Regiment
Sandston, VA

Well that does it for this month. Special thanks goes to Jack Metcalf for his help in compiling this month's column. Until next time, 73 and good hunting.

TRACKING THE TRUNKS

TECHNOLOGY, EQUIPMENT, FREQUENCIES AND NEWS

Dan Veeneman

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<http://www.signalharbor.com>

Testing, Testing ...

Installing a new digital trunked radio system is not easy. Trunking is inherently more complex than conventional radio operation, and adding digital voice to the mix creates a lot of opportunities for problems. Every new system must be tested and checked out before being cleared for full operation, and this process takes time. This month we'll take a look at a few systems that have been in the works for a while and are just coming on-line.

Howard County, Maryland

Howard County is located in Maryland between Baltimore and Washington, D.C. The county's public safety agencies have begun to use a new Motorola Type II ASTRO trunked radio system with mixed analog and digital voice traffic. Unfortunately for scanner listeners, the digital voice is Motorola's proprietary VSELP (Vector-Sum-Excited Linear Prediction) voice encoder-decoder (vocoder) rather than the Project 25 standard IMBE (Improved Multi-Band Excitation). What this means is that a digital scanner will follow conversations and display talkgroups but will be unable to decode any digital voice traffic. Fortunately, most channels are currently operating in analog mode.

Frequencies in use are 857.2375, 857.7375, 866.0375, 866.0625, 866.3875, 866.5375, 866.5750, 866.6875, 866.9625, 866.9875, 867.1125, 867.6375, 867.8000, 868.0375 and 868.0625 MHz.

During the transition phase the county is simulcasting several channels on their old conventional VHF system (PL tone is 103.5):

Fire Dispatch	154.250
Fireground	154.220

Mutual Aid	154.175
Police (North)	159.090
Police (South)	155.115
Car-to-Car	155.370
Police 2	155.595

Montgomery County, Maryland

Just to the west of Howard County lies Montgomery County, perhaps most famous these days as the home of Chief Charles Moose, the head law enforcement officer in the county who headed up the investigation into the D.C.-area sniper shootings last October. During that time the county's new Motorola ASTRO digital trunked radio system was placed into operation, initially providing service to about 130 radios.

The new system uses the Project-25 Common Air Interface (CAI), including the IMBE vocoder. Like Howard County it is a mixed system, supporting both analog and digital traffic. It uses a 3600-baud control channel and is fully trackable on a digital scanner.

The current system has fourteen repeater sites scattered around the county, all operating in simulcast mode. The locations include Bethesda, Boyds, Damascus, Dickerson, Gaithersburg, Germantown, Mount Airy, Olney, Poolesville, Rockville, Silver Spring, Spencerville, Takoma Park and Wheaton.

The system uses the following frequencies: 866.2125, 866.2750, 866.3375, 866.4875, 866.6500, 867.7375, 867.8375, 867.8875, 867.9125, 868.1625, 868.3625, 868.3875, 868.4375, 868.6125, 868.6375, 868.6875, 868.8625, 868.8875 and 868.9375 MHz.

Some identified talkgroups:

3344	Fire Dispatch
3376	Fire Operations
4336	National Naval Medical Center (Bethesda)
13168	Police (South)
13264	Police (North)

A number of talkgroups are encrypted, primarily for police tactical operations.

Phoenix/Mesa, Arizona

The cities of Phoenix and Mesa, Arizona, continue to make

progress in their effort to install a Project-25 compliant trunked radio network purchased from Motorola. Each city will operate independent systems but will work closely together to provide service across the entire metropolitan area. The initial plan is to support voice operations for as many as 15,000 radios.

Phoenix will carry the bulk of the load, including four separate simulcast sub-systems. Basically, police and fire will each have their own sub-system operating from nine repeater sites, along with West Valley (five sites) and Tempe (four sites). Additional, smaller single-site sub-systems will cover outlying segments of the metropolitan area as part of the Phoenix network. Mesa will have a distinct public safety and city service sub-system transmitting from nine sites.

As with Michigan and other "pure P-25" systems, the Phoenix/Mesa network will use Project-25 standards, including trunking, so the new Uniden digital scanners will not trunk-track these transmissions (see 9600 baud item below).

The entire system, as you might imagine, uses an enormous number of frequencies. Rather than list all of them here, I would refer you to a couple of web sites that have the details. Lindsay Blanton operates a very comprehensive trunked radio database at <http://www.trunkedradio.net>. You'll need to register in order to use it, but it contains a wealth of frequency and talkgroup information. Many volunteers assist Lindsay in compiling and maintaining the database, and it is constantly being updated.

You will also find frequency listings, derived from the databases of the Federal Communications Commission (FCC), on my web site at <http://www.signalharbor.com>. In those listings you will find known and suspected Project-25 frequencies and repeater site locations organized by state.

State of Ohio

Testing continues on the Ohio Multi-Agency Radio Communication System (MARCS), with coverage in more than a dozen central Ohio counties. State Police posts currently using the system include Chillicothe, Circleville, Delaware, Granville, Jefferson, Lancaster, Marion, Mt. Gilead and West. All patrol posts are expected to be using the system by the end of next year.

The MARCS system has the ability to deliver computer data as well as voice traffic, and the Ohio State Police plans to make use of that capability. Ohio State patrol cars will be equipped



with laptop computers and a data connection to MARCS, allowing troopers to call up license and vehicle registration information without having to call a dispatcher. It will also provide a link to state criminal and warrant lists, the National Crime Information Center (NCIC), hazardous materials information, and other databases.

Interestingly, MARCS is also expected to relay the location of patrol cars to dispatch centers in real-time. Each car will be equipped with a Global Positioning System (GPS) receiver, which will provide location data to dispatchers (and perhaps other cars) across the radio link. A monitor in the dispatch center will overlay the car's position on a map, making it easier to assign troopers to incidents and to coordinate backup and emergency support.

For the details about the voice side of MARCS, see Tom Swisher's web site at <http://www.qsl.net/wa8pyr/marcs.htm> and Joe Mamich's page at <http://www.qsl.net/kb8vju/marcs.htm>.

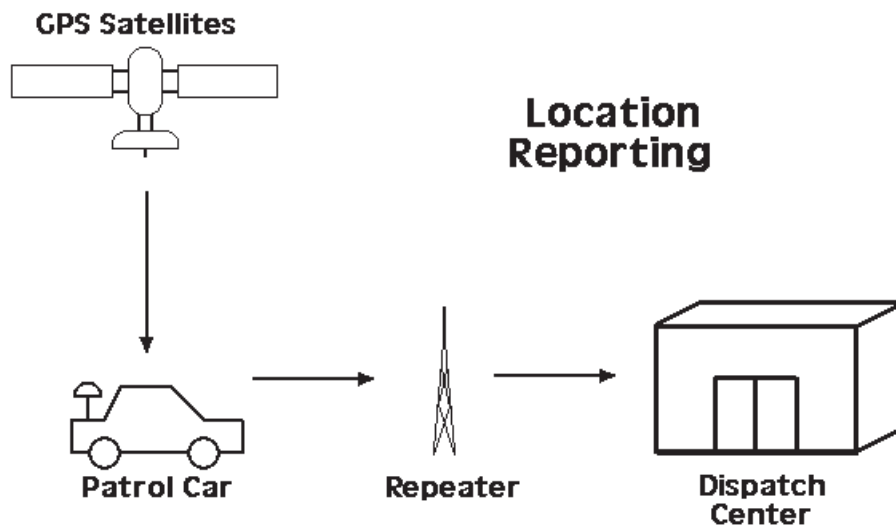
New York, New York

The New York Fire Department has finished a two-year series of investigations and tests of their new \$15 million digital radios and has reissued them to firefighters. About 3,500 radios were withdrawn from service back in early 2001, just a week after being introduced, when a distress call from a fireman inside a Queens house fire was not heard. Since that time the Department has been using older radios, which may have been partially to blame for the inability of rescue teams to communicate inside the World Trade Center on September 11, 2001.

Several changes have been made to the five-watt UHF radios, which cost more than \$3,000 each. Besides knob and speaker changes, and the addition of an emergency button, the most interesting change is the decision to revert back to analog voice. Even though fire officials say it was a training issue, firefighters did not like the echoes and other audio artifacts from the digital voice radios. They were also troubled with the half-second speech delay imposed by the relatively long vocoder encoding and decoding process. Even though the radios are capable of digital operation, most channels are strictly analog only.

Since the radio reissue occurred so recently, scanner listeners are still working out the proper frequency assignments. Fireground handheld radios apparently have sixteen channels assigned, most running in analog mode. These frequency assignments reportedly have a bandwidth of 6.25 kHz, which is narrow compared to the usual 12.5 kHz spacing.

1	Tactical	486.1125
2	Command	485.1875
3	Tactical 2	486.2625
4	Channel 4	487.2625
5	Channel 5	487.1375
6	Channel 6	485.2625
7	Channel 7	486.1375
8	Channel 8	485.0625
9	Channel 9 (Digital)	486.01875
10	Emergency Medical Services	487.4875
11	In-Building Repeater	483.0125
12	In-Building Repeater (Digital)	483.00625
13	Mobile Repeater	484.7625



Ohio's MARC System

14	Subway Repeater	460.575
15	Subway Repeater	460.625
16	Emergency	486.7375

This is preliminary information – please e-mail me with updates!

Tracking 9600-baud systems

Dan,

I read your column every month and I wanted to let you know that I found your February 2003 column to have very valuable information concerning Michigan's APCO-25 radio system. This is the first I have heard that Michigan's system is 9600 baud and will not be receivable on the new Uniden scanners being introduced. I was considering purchasing one but will wait until Uniden possibly introduces a scanner compatible to Michigan's system. I enjoy your column and think you're doing a fine job.

Thanks, Les in Davison, MI

Michigan's statewide APCO Project 25 system has been covered in *Tracking the Trunks* several times in the past. Michigan elected to use the Project 25 standard trunking protocol, which specifies a control channel signaling protocol operating at 9600 baud. The new Uniden scanners, the BC250D and BC785D, are only capable of trunk tracking systems that use a different, 3600-baud control channel. However, with the APCO-25 add-on BCi25 card, the scanners are able to decode the voice portion of digital transmissions. By operating the scanner in conventional rather than trunked mode, a listener could hear the activity but might have difficulty following an entire conversation.

Understandably, many scanner listeners in areas served by 9600-baud systems are reluctant to spend upwards of \$700 on a scanner that will not follow conversations. However, for those willing to wait, there may be a solution before the end of the year.

Radio Shack digital scanner?

Now that the new Uniden digital trunk

tracking scanners are on the market, the rumor mill has begun to discuss the possibility of another digital scanner becoming available in the near future.

More than a year ago Radio Shack indicated they were working on an add-on product that would decode digital trunked transmissions. Beyond that announcement in a newspaper interview, not much has been heard from the folks in Fort Worth – until recently. Apparently Radio Shack and GRE are working on a handheld scanner that will successfully monitor APCO-25 systems. Rumor has it that the scanner will also track systems using 9600-baud control channels as well as 3600-baud systems. The new scanner is expected to be in stores in time for the Christmas 2003 shopping season and will probably have a price tag of somewhere around \$500.

Scanner Software

Mike Agner, KA3JJZ, writes in to remind readers that he maintains a very comprehensive list of software packages for a variety of scanners at <http://www.strongsignals.net/access/content/software.html>

The page is separated into sections, including numerous entries for trunk tracking support software for both analog and digital scanners.

Software packages that support the new Uniden digital scanners are available now, and the list continues to grow for both shareware and commercial products. The general opinion seems to be that the Escanner software that comes with the scanners isn't worth the effort to install. It has very few useful features and is difficult to remove after you decide you don't want it. Alternatives include Trunk Manager, which reportedly works well with the BC250D (and most likely the 785D as well), and Butel's ARC250. I'm sure there are other worthwhile software packages out there.

That's all for this month. I welcome your electronic mail about digital trunking, scanner software, or any other radio topic at danveeneman@monitoringtimes.com, and as always more information is available on my website at <http://www.signalharbor.com>. Until next month, happy monitoring!

Potomac Consolidated TRACON

Welcome aboard! We have more aero frequencies for you today, as well as information about our new Potomac TRACON. First of all, I want to thank Ron for contributing a lot of the Potomac information. He also passed along a really excellent website — http://www.selcal.co.uk/data_base_download_page.htm contains all kinds of goodies, such as databases for selcal IDs, airlines, call signs, and HFDL (High Frequency Data Link). Check it out!

◆ The Potomac Consolidated TRACON

In the Baltimore-Washington Metropolitan area, there are *five* major airports: BWI; Washington National, Washington Dulles, Andrews AFB, and Richmond, VA. This mixture of airspace with each airport having its own TRACON has produced a lot of anxiety for air traffic controllers and pilots over the years, as you can well imagine.

So that the rest of this news item makes sense to monitors who are new at the hobby of listening to VHF aero frequencies, let's go over what a TRACON actually does. (Stop groaning, old-timers, it doesn't hurt any of us to go back to basics once in a while!) Thanks to the FAA for these exact definitions of TRACON controllers' duties and responsibilities! (Check

out one of their websites at http://www2.faa.gov/ats/potomac/ATC_Basics.htm Note the underline between the words ATC and Basics.)

"TRACON is an acronym for Terminal Radar Approach Control. They are usually located on or near the airport grounds. Controllers in a TRACON guide traffic approaching or departing between 5 and 50 miles of the airport. Radar equipment allows the controllers to watch the aircraft at these distances.

"Usually, each TRACON has responsibility for controlling specifically defined and limited sections of airspace. That involves ensuring that all aircraft entering or departing the airspace are kept separated at safe distances. When necessary, TRACONs reroute aircraft to avoid dangerous weather patterns.

"A TRACON's total airspace is subdivided into smaller sections called sectors. Each sector is assigned to an individual air traffic controller who works in the TRACON facility. That controller directs the movement of aircraft in and out of that space on an individual radar screen and maintains voice contact with pilots. Although the controller's individual responsibility is only for his or her own sector, all controllers within a TRACON have full radar information on all the aircraft that are under control of the entire TRACON facility. Because they are co-located, these controllers are able to communicate with one another instantaneously — something that contributes significantly to assuring the safety of aircraft passengers.

"By contrast, in a control environment such as that which exists in this region today, controllers in one TRACON have limited ability to communicate with controllers in adjacent TRACONs. This is true even though aircraft will pass from the airspace controlled by one TRACON into that of another. "Hand-offs," the transfer of control and separation responsibility between TRACONs, are routine within the Washington-Baltimore area. To assure the safety of such hand-offs today, aircraft in this region often must use longer routes than would be necessary in a single TRACON. In other words, some efficiency is sacrificed to safety concerns, as it should be in a system that puts safety first."

On December 1st, 2002, the FAA officially opened the Potomac TRACON (PCT), which is located in Vint Hill, VA, approximately 20 miles southwest of Dulles International airport.

Eventually, it will consolidate controllers from the Dulles, Baltimore, Andrews AFB,

Reagan National, and Richmond (VA) TRACONs into one facility. Airspace changes will take effect in mid to late 2003 in conjunction with this move. In the meantime, operators can expect some intermittent delays or restrictions in and around the Washington DC terminal airspace as controllers transition to new equipment in PCT TRACON.

Dulles was the first full cutover from their TRACON to PCT. A "shadow operation" will remain intact at Dulles in case of catastrophic failure with four controllers remaining in the old Dulles TRACON 24/7 for this back-up function. It was said that operations at Dulles could be significantly impacted in the event operations had to move back to the old TRACON.

DCA (Washington National) will start phasing in later this month (February), or early next month (March). By the time you read this, the phase-in may or may not be complete. The schedule for the complete switchover is as follows (at this writing): Washington Dulles, Washington National, Andrews AFB, Richmond International, and Baltimore-Washington International. When the consolidation is complete, the Potomac TRACON will have about 300 FAA employees who will handle approximately 5,000 flights a day in 23,000 square miles of airspace. The individual airport towers will not be affected, and FAA controllers will, of course, continue to staff them.

Later this year, the FAA will begin implementing redesign of the Potomac airspace in the Baltimore-Washington Area. Under the current design, which has been in place for about four decades, the local airspace was rigidly partitioned among the four airports. That resulted in rigid routes for safety reasons as airplanes flew from one airport's airspace to another. As William Shumann also said in his press release last December, "Removing these barriers will allow aircraft to fly more direct routings, reach higher altitudes more quickly, and stay higher longer. The result is less fuel burned and reduced noise impacts."

National security requirements in and around the Washington, DC, metropolitan area have also resulted in numerous restrictions being placed on airspace use. The combined factors of increased traffic volume, proximity of airports, the mix of aircraft with widely varying operating characteristics, and special use airspace requirements, have compounded operational complexity and degraded overall operational efficiency.



You don't want to see the toolboxes out when it's your plane they're working on! (Photo by Harry Baughn)

Washington Dulles International Airport (KIAD)

Washington, District of Columbia, USA

ATIS: 134.850

UNICOM: 122.950

(Potomac) Approach:

120.450 (241-330)

124.650 (091-240)

124.650 (091-330)

126.100 (331-090)

Clearance Delivery: 135.700/317.800

(Potomac) Departure:

25.050 (300-120)

126.650 (121-299)

Ground Control:

121.900 (East)

132.450 (West)

317.800 (East)

348.600 (West)

Tower:

120.100 (Runway 01R/Runway 19L)

128.425 (Runway 01L/19R)

128.425 (Runways 01L/19R, 12/30)

317.800 (Runway 01R/19L)

348.600 (Runways 01L/19R, 12/30)

Emergency: 121.500/243.000

Midfield Ramp Control: 129.550

ATCC: Washington Center

FSS: Leesburg Flight Service Station

Baltimore-Washington International Airport (KBWI)

Baltimore, MD

ATIS: 115.100, 127.800

Approach Control:

119.000 (020-100)

119.700 (131-180)

124.550 (101-130)

128.700 (181-019)

282.275 (020-100)

290.475 (131-180)

307.900 (181-019)

317.425 (101-130)

125.300, 291.625

Clearance Delivery: 118.050; As assigned: 317.425

Departure Control: 128.700, 124.550, 133.750

Ground Control: 121.900

Tower: 119.400/257.800

Emergency: 121.500/243.000

ARTCC: Washington Center

FSS: Leesburg Flight Service Station

✦ Airport Frequencies across the U.S.

Anchorage (Ted Stevens) International Airport (PANC)

Anchorage, AK

ATIS: 118.000

UNICOM: 122.950

Approach: 118.600, 119.100, 123.800, 126.400, 134.100,

257.900, 290.500, 363.200

Clearance Delivery: 19.400, 323.100, 128.650

Departure: 118.600, 119.100, 123.800, 126.400,

257.900, 290.500, 363.200

Ground: 121.900

Tower: 118.300/257.800

Emergency: 121.500/243.000

ANG OPS: 148.675, 311.000

USB ANG OPS: 4897.5

ARTCC: Anchorage Center

FSS: Kenai Flight Service Station

"Oceanic Polar Flights and Flights with Aleutian Chain Destinations requesting above FL 270 contact Anchorage ARTCC on frequency 127.550 for clearance prior to starting engines."

Orlando International Airport (KMCO)

Orlando, FL

ATIS: 120.525, 121.250

UNICOM: 122.950

Approach:

119.400 (181-310 5500 & below)

120.150 (181-359 above 5500)

121.100 (311-060 5500 & below)

124.800 (000-180 above 5000)

127.325 (061-180 5000 & below)

284.700 (181-359 above 5500)

307.000 (000-180 above 5000)

351.900 (311-060 5500 & below)

123.850, 125.550, 134.050, 339.800

Clearance Delivery:

134.700, 341.700

RWY 17/35: 118.450

RWYS 18L/36R & 18R/36L: 124.300

Departure:

119.400 (181-310 5500 & below)

120.150 (181-359 Above 5500)

120.525, 121.100 (311-060 5500 & below)

124.800 (000-180 above 5000)

127.325 (061-180 5000 & below)

284.700 (181-359 above 5500)

307.000 (000-180 above 5000)

351.900 (311-060 5500 & below)

Ground: 121.800/275.800

Tower: 118.450, 123.300, 253.500

Emergency: 121.500/243.00

ARTCC: Jacksonville Center

FSS: St. Petersburg Flight Service Station

Thanks to Grace M.

Boise Air Terminal/Gowen Field (KBOI)

Boise, ID

ATIS: 123.900/290.400

UNICOM: 122.950

Approach: 119.600 (South), 126.900 (North), 269.400

(South), 351.850 (North)

Clearance Delivery: 125.900/323.200

Departure: 119.600 (South), 126.900 (North), 269.400

(South), 351.850 (North)

Emergency: 125.500

ANG OPS: 298.700

NG OPNS: 41.5

ARTCC: Salt Lake City Center

McCarren International Airport (KLAS)

Las Vegas, NV

ARTCC: Los Angeles Center

Approach: 125.0250, 379.150

VFR Final Approach: 120.4

Clearance Delivery: 118.000/379.950

Class B:

118.4.00 (East of Interstate 15, South of 080 R)

125.020 (280-360)

125.020 (360-080)

125.900 (W of Interstate 15; S of 280 R)

353.700 (East of Interstate 15, South of 080 R)

353.700 (W of Interstate 15, South of 28 R)

379.150 (280-360)

379.150 (360-080)

Departure:

125.020 — North

125.900 — South

3379.150 — North

380.050 — South

Ground Control: 121.100; 121.900; 254.300, 385.500

Ramp Control:

124.400 (Terminals A, B, C & Charter)

127.900 (Terminal D)

Tower:

118.750 (Runway 01/19)

119.900 (Runway 07/25)

257.800

Emergency: 121.500/243.000

Thanks to John B.

Port Columbus International Airport (KMCH)

Columbus, OH

ATIS: 124.600

UNICOM: 122.950

Approach:

119.150 (100-279)

125.950 (280-099)

388.800 (280-099)

392.100 (100-279)

118.200; 119.650; 353.900

Clearance Delivery: 126.300

Departure:

119.150 (100-279)

125.950 (280-099)

388.800 (280-099)

392.100 (100-279)

Ground Control: 121.900/348.600

Tower: 132.700/257.800

Emergency: 21.500/243.000

ARTCC: Indianapolis Center

FSS: Dayton Flight Service Station

Rickenbacker International Airport (KLCK)

Columbus, OH (Mainly for General Aviation Services)

Approach (Columbus): 119.150

Departure (Columbus): 119.150

Emergency: 121.500/243.000

Ground: 121.850/275.800

Tower: 120.050/348.400

NG OPNS: 286.200, 311.300

ARTCC: Indianapolis Center

FSS: Dayton Flight Service Station

Fort Wayne International Airport (FWA)

Fort Wayne, IN

ATIS: 121.250/349.000

UNICOM: 122.950

Approach:

127.200 (SW/NW of active runway)

132.150 (SE/NE of active runway)

260.600 (SE/NE of active runway)

284.600 (SW/NW of active runway)

135.325

Clearance Delivery: 124.750

Departure:

127.200 (SW/NW of active runway)

132.150 (SE/NE of active runway)

260.600 (SE/NE of active runway)

284.600 (SW/NW of active runway)

135.325

Ground Control: 121.900/348.600

Tower: 119.100/272.725

Emergency: 121.500/243.000

ARTCC: Chicago Center

Thanks to R.S.R.

In the June issue, we'll go into more details regarding the new TRACON as I receive them. If National's approach/departure frequencies have been added to the Potomac facility, we'll list those, along with Andrews and Richmond's total frequencies as well (although we did list them just a few months ago).

Until then, 73 and out.

Music Returns?

One of the most obvious changes to the AM dial over the last 30 years has been the disappearance of popular music from the airwaves. Growing up in Milwaukee in the 1970s, we had three pop-music stations on AM. Three more in Chicago competed for our attention. But over the years, all six are gone. WOKY runs nostalgia; WZUU is now programming to the African-American audience; WRKR and WIND are both Spanish-language outlets; WLS and WCFL are talkers. If you want popular music, you have to listen to FM.

But maybe not anymore, at least in some cities. One of the more interesting bits of news to come along in January was the switch of WSAI-1530 Cincinnati from nostalgia to oldies. This was followed a few days later by a similar announcement by WWKB-1520 Buffalo. In Buffalo, the change will be accompanied by a return to classic "KB" jingles. DJ Danny Neaverth, who built his career at the station when it was known as WKBW, is also coming back. (WKBW was forced to change call letters to WWKB when it was sold separately from WKBW-TV. FCC regulations have since changed to allow unrelated stations on different bands to share the same call letters; AM 1520 has applied to change back to WKBW.) Former WKBW DJ Joey Reynolds will also be back on the AM 1520 airwaves, but with his syndicated overnight talk show.

Will we see this kind of change on other stations? That's a good question. As a 40-something, I hate to admit it, but... The records we listened to in college are now "oldies." The ones we listened to in high school are now "classic rock." And the ones we listened to in middle school are now "nostalgia." I think we'll hear more.

❖ Bits and Pieces

• Speaking of Cincinnati, Mark Morgan, N8QIK, writes from the Queen City. At 7:30pm on Christmas Day, he heard a continuous loop on 1360 kHz. This loop said "CBS Radio Network, Channel 45," and "This is the correct channel for CBS Sports coverage of the NFL on Westwood One." It would seem something went wrong with the automation at WCKY, Cincinnati, causing the station to leave a satellite feed on the air long after the game was over. This kind of thing is actually fairly common. Unfortunately it's generally impossible to identify the offending station.

• Todd Emslie, posting to a discussion group on the Internet, mentions the Australian MW DX Group. Their website is on <http://home.iprimus.com.au/onleydw/mwoz/>. The DX Group discusses AM news, loggings and QSL information relevant to Australian DXers. Much of this information would likely be of value to West Coast USA/Canadian DXers as well. Incidentally, Todd has repeated his exciting work with intercontinental TV reception via lunar reflection. This time, the TV DX targets are European. Fourteen 500kW and 1000kW stations in Sweden, Germany, England, Spain, France, Austria, and Finland are listed. Congratulations!

• Mike King, K3CXG, in Maryland suggests IBOC test station **WD2XXM** has moved from 650 to 1670. On December 19, they were playing brief snippets of music, with IDs on the hour and 15 minutes after. As of January 17 Mike hadn't yet received a reply to a reception report. Also reaching Maryland in the expanded band is the widely-heard Lubovitcher pirate station on 1710 kHz. This station is believed to be located in Brooklyn. Programming is Jewish religion, in both English and Hebrew. DXers who have reported reception to the National Radio Club's *DX News* have received (unsolicited!) verifications with a return address of 770 Eastern Parkway, Brooklyn, NY 11213.

• My recent "Moving Day" column referred to stations moving to new frequencies. It's not unusual for stations to move their physical location instead. These moves are almost always within the same area – moving from one tower to a new one a few miles away, etc.. Occasionally, the moves are somewhat further.

Around the first of the year, **WMQM**-1600 appeared on the air from Lakeland, Tennessee. WMQM is a 50,000-watt daytime religious station, and Lakeland is a suburb about 15 miles northeast of Memphis. Many listeners seem to believe WMQM is a completely new station. But a quick check of the FCC database shows otherwise. WMQM is the former **WKBJ**, which went silent from its location in Milan, Tennessee. WMQM's new tower is 85 miles southwest of the old WKBJ site.

Another station that's

trying to move even further is **WHTE**-1690 Johnson City, Illinois. This expanded-band station is associated with **WDDD**-810. They've not yet signed on the air, and now have filed a request to move the expanded-band station to Berwyn. Berwyn is a Chicago suburb. In January, WHTE's owners applied to move WDDD-FM from Marion, Illinois, to Johnson City. That move would ensure Johnson City would still have a radio station after WHTE moves to Berwyn and WDDD-AM leaves the air, as will be required five years after their expanded-band station shuts down. To my knowledge there's been no FCC action on any of this...

• A nine-year Nashville broadcasting tradition has come to an end. Low-power TV station **W52CT** is actually running programs! Shortly after I moved to my current location in 1994, **W52CT** dropped their "The Box" pay-per-view music videos and put up a test pattern. The test pattern finally disappeared in January 2003 in favor of the America One network. I guess I'm going to have to actually borrow a test generator next time I want to set up a TV set<grin>!

It's been a productive winter here, with sixteen new stations logged in December alone. How's your log doing? Write me at Box 98, Brasstown NC 28902-0098, or by email to dougsmith@monitoringtimes.com. Good DX!

Pat Griffith's (Denver, Colorado) recent AM QSLs:

WPD1548-540	Denver International Airport
KJCK-1420	Junction City, Kansas
KFTI-1070	Wichita, Kansas
KOZN-1620	Bellevue, Nebraska (Omaha)
CBK-540	Watrous, Saskatchewan (Regina)



WQSV-790, a typical small Southern gospel-music station.

Iraq War Clandestines Continue

As we reported last month, the airborne USA-sponsored Information Radio continues to broadcast on a daily basis in Iraq on 9715 and 11292 kHz shortwave, supplemented by 756 and 693 kHz AM medium wave, and an FM service on 100.4 MHz between 1500-2000 UTC. Loggings of this one have been fairly common in Europe, but North American loggings continue to be rare, unlike the many scores of logs of this station while it was active toward Afghanistan about a year ago.

In fact, the only two apparent loggings of this station that *MT* has seen from a North American location come from your editor, George Zeller, at a DXpedition at French Creek State Park in Pennsylvania, and from Walter Salmaniw in British Columbia. Both your editor and Walter heard this one on 9715 kHz around 1700 UTC, but neither one of us copied an ID. Programming is a mix of Arabic language political talks and some popular music, some of which is western music. Although this one is turning out to be a difficult DX catch, the fact that the station apparently can be heard should motivate us to keep checking for it.

◆ Hit Shortwave

There have been numerous reports in the DX press of a station called *Hit Shortwave*, presumably broadcasting to Afghanistan on a clandestine basis. The station operates on 4050 kHz, but despite repeated checks, your editor was unable to hear this one at the French Creek DXpedition, despite some excellent receivers and a very long antenna in a quiet location. Has anybody else managed to snag this very tough DX catch?

However, at the DXpedition I was able to duplicate the logging that Woody Smith had of the Voice of New Sudan, a clandestine operating on 6985 kHz in the 0400 UTC time frame. This one is right in the North American pirate band, so it should be easy to find.

◆ Pirate Activity Patterns

Every month we keep an eye on the broadcasting patterns of North American shortwave pirate radio stations. During the last couple of months there has been a significant shift in station operating habits. Normally, most pirate stations transmit on or near 6955 kHz, at random times, so as to minimize their odds of detection by governmental authorities.

But, during 2003 there has been a significant shift in this frequency pattern used by pirates. About two-thirds of all pirate broadcasts from

North America have moved down to 6950 kHz. Many stations have given up fighting against the Peruvian broadcaster *Radio La Voz del Campesino*, which often occupies the 6956.5 frequency in North America. When this Peruvian is coming in, many pirates are moving down slightly so as to avoid mutual interference with *Campesino*.

This does not mean that no stations use 6955 kHz anymore. Some pirates still pop up on the traditional pirate frequency, especially if the channel is clear. In fact, pirates can be found scattered across the entire shortwave spectrum on an unpredictable basis. In recent years a majority of the pirates have operated in upper sideband mode, but a minority of pirate transmitters still are heard using AM modulation. A smaller handful will sneak down to lower sideband mode occasionally.

◆ Arthur in, Helms Retires, at ACE

The Association of Clandestine Radio Enthusiasts, still the largest radio club in North America that specializes in unlicensed broadcast DXing, has announced that publisher Harry Helms has resigned after a stint at this club's helm. As reported previously in *MT*, Harry experimented with the production of an Acrobat .pdf file of *The ACE* bulletin each month. Harry's resignation resulted from a time conflict with his job, and his innovative work will be missed. ACE announces that John T. Arthur has once again assumed the duties of publishing the bulletin.

◆ What We Are Hearing

Our readers heard all of these North American pirate broadcasters this month. Pirate broadcasting increases noticeably on weekends, and during major holiday periods.

Big Thunder Radio - This new one has been programming reggae music, with a claim that the shows are coming from Interstate 29 near Kansas City. (Uses bigthunderradio@hotmail.com e-mail)

Captain Morgan - The captain remains active with a rather strange mix of unstructured rock music shows and Twilight Zone audio. (None, asks for reports on the Free Radio Network)

Cupido Radio - This Europirate, using 21895 kHz around 1400 UTC, has been making it into some parts of North America on certain weekends. (Oldebroek)

Indira Calling - They still are the king of All India Radio parodies on the pirate bands. (Providence)

KIPM - This station's psychological dramas with announcer Alan Maxwell produce mixed reactions by listeners. The shows are

designed to question everybody's sanity. (Elkhorn)

Mystery Science Radio - Cherokee Jack has been sending out QSL's from this science fiction station. (Elkhorn)

Puxatawny Pothead Radio - This one appeared around Groundhog day with old pop music and a strange announcer's voice. The groundhog did not see his shadow. (Belfast)

Radio Free Speech - Bill O. Rights is back with his shows that promote both individual liberty and pirate broadcasting. (Belfast)

Sycko Radio - This one was inactive for a long period of time, after previously being the most active station on the North American pirate band. But, it has now returned with rock music and jingles. The spelling of the station name remains doubtful; it's pronounced "psycho." (Still none)

The Crooked Man - Some DXers think that this is the most bizarre radio station of all time. The "crooked" announcer claims to be somewhat offbeat because of an unfortunate fall from the Hindenburg when it crashed. The announcer allegedly landed on his head in this tragic incident, accounting for his stream of consciousness discussions. (None)

Undercover Radio - Dr. Benway has been airing mixes of rock music and odd narrative sketches memorializing William S. Burroughs. (Merlin)

Voice of Bizarro World - Xhem is back with his backwards programs. They sign on with a sign-off announcement, and then they welcome listeners to the show as they sign off. (Used to verify, but no address announced lately)

Voice of Captain Ron Shortwave - Here's our second captain of the month. His shows feature a classic pirate mix of rock music and comedy sketches. (Uses captainronswr@yahoo.com e-mail)

WBST - Claiming to be operated by the Lucifer Broadcasting System, this one specializes in Halloween programming. But, the shows can be heard at any time of the year, not just around the holidays. (None current)

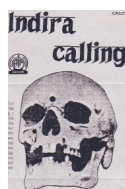
WHYP - Technically, James Brownard's station memorializes a small town medium wave station in North East, PA. But, normally his shows contain humor about the pirate scene. (Providence)

WMPR - Techno "dance party" rock music with a "micropower radio" slogan remains the standard format on this one. (Still none; occasionally verifies loggings in pirate DX bulletins)

WSRR - Dr. Love at Solid Rock Radio has showed up from time to time via a licensed relay. Thus, his shows on 7385 and 15725 kHz are not technically pirate broadcasts. (Belfast)

◆ QSLing Pirates

Reception reports to pirate stations require three first class stamps for USA maildrops or \$2 US to foreign locations. The cash defrays postage for mail forwarding and a souvenir QSL to your mailbox. Letters go to these addresses, identified above in parentheses: PO Box 1, Belfast,



continued on page 73

Loral Skynet Telstar 6

C-Band - 93 degrees West longitude

1(V)	3720	Occasional video
2(H)	3740	Data Transmissions
3(V)	3760	Occasional video
4(H)	3780	Occasional video
5(V)	3800	Data Transmissions
6(H)	3820	Occasional video
7(V)	3840	Occasional video
8(H)	3860	Occasional video
9(V)	3880	Occasional video
10(H)	3900	Fox Network affiliate feeds (digital)
11(V)	3920	Occasional video
12(H)	3940	Occasional video
13(V)	3960	Fox Network affiliate feeds (digital)
14(H)	3980	Occasional video
15(V)	4000	Occasional video
16(H)	4020	Occasional video
17(V)	4040	Occasional video
18(H)	4060	Occasional video
19(V)	4080	Occasional video / CBS Network affiliate feeds (digital)
20(H)	4100	CBS Network affiliate feeds (digital)
21(V)	4120	Occasional video / CBS Network affiliate feeds (digital)
22(H)	4140	Occasional video / CBS Network affiliate feeds (digital)
23(V)	4160	CBS Network affiliate feeds (digital)
24(H)	4180	Occasional video

Loral Skynet Telstar 6

Ku-Band - 93 degrees West longitude

1(V)	11728.5	CBS Satellite Newsgathering (digital)
2(H)	11735.0	Reuters (digital) / Data Transmissions
3(V)	11789.5	CBS Satellite Newsgathering (digital)
4(H)	11796.0	Occasional video
5(V)	11836.0	Data Transmissions
6(H)	11842.5	Data Transmissions
7(V)	11867.0	Occasional video / University Network - Dr. Gene Scott (digital)
8(H)	11873.5	WSNet (digital)
9(V)	11898.0	Occasional video
10(H)	11904.5	WSNet (digital)
11(V)	11929.0	CBS Satellite Newsgathering (digital)
12(H)	11935.5	Data Transmissions
13(V)	11960.0	Data Transmissions
14(H)	11966.5	Occasional video
15(V)	11991.0	WSNet (digital)
16(H)	11997.5	Occasional video
17(V)	12022.0	Occasional video
18(H)	12028.5	WSNet (digital)
19(V)	12053.0	Occasional video
20(H)	12059.5	Occasional video
21(V)	12084.0	Data Transmissions
22(H)	12090.5	Occasional video
23(V)	12115.0	Data Transmissions
24(H)	12121.5	Fox Satellite Newsgathering (digital)
25(V)	12146.0	Occasional video
26(H)	12152.5	Data Transmissions
27(V)	12177.0	WSNet (digital)
28(H)	12183.5	Occasional video

Panamsat Galaxy 3C

C-Band - 95 degrees West longitude

1(H)	3720	Occasional video
2(V)	3740	Occasional video
3(H)	3760	Occasional video
4(V)	3780	Occasional video
5(H)	3800	Occasional video
6(V)	3820	Occasional video
7(H)	3840	Occasional video
8(V)	3860	Occasional video
9(H)	3880	Occasional video
10(V)	3900	Horse Racing (digital) (occ) / Gem Shopping Network (digital)

11(H)	3920	Horse Racing (digital) (occ)
12(V)	3940	Horse Racing (digital) (occ)
13(H)	3960	Horse Racing (digital) (occ)
14(V)	3980	Horse Racing (digital) (occ)
15(H)	4000	Occasional video
16(V)	4020	Occasional video
17(H)	4040	Occasional video
18(V)	4060	Occasional video
19(H)	4080	Occasional video
20(V)	4100	Occasional video
21(H)	4120	America One Television
22(V)	4140	Occasional video
23(H)	4160	Occasional video
24(V)	4180	Occasional video

Panamsat Galaxy 3C

Ku-Band - 95 degrees West longitude

T01(H)	11720	Occasional video
T02(V)	11750	Data Transmissions
T03(H)	11750	FM2 services
Data transmissions .06, 2.93, 3.01, 3.07 and 3.15 MHz		
In-Store audio network ads (various companies) .62, .71, .81, .88, 1.05, 1.15, 1.26, 2.06, 3.25, 3.44, 3.62, 3.69, 3.76, 3.88, 3.97, 4.20, 4.55 and 4.64 MHz		
Muzak Services .15, .27, .39, .51, .98, 1.36, 1.48, 1.60, 1.72, 1.84, 1.96, 2.19, 2.31, 2.44, 2.56, 2.68, 2.80, 3.34, 3.53, 4.08, 4.32, and 4.45 MHz		
T04(H)	11780	CCTV-4 and CCTV-9 (digital)
T05(V)	11810	Data Transmissions
T06(H)	11810	Occasional video
T07(H)	11840	Data Transmissions
T08(V)	11870	Data Transmissions
T09(H)	11870	Data Transmissions
T10(H)	11900	Data Transmissions / Occasional video
T11(V)	11930	Data Transmissions
T12(H)	11930	Occasional video / Channel One (occ)
T13(H)	11960	Data Transmissions
T14(V)	11990	Data Transmissions
T15(H)	11990	Occasional video
T16(V)	12020	FM2 Services
Data transmissions .06, .47, .53, .68, 1.95, 2.18, 2.45, 2.52, 2.82, 2.92, 3.20, 3.40, 3.97, and 4.14 MHz		
In-Store audio networks .15, .27, .39, .99, 1.11, 1.59, 1.71, and 1.83 MHz		
T17(V)	12050	Occasional video / Data Transmissions
T18(H)	12050	Occasional video
T19(H)	12080	Data Transmissions
T20(V)	12110	Data Transmissions
T21(H)	12110	Occasional video
T22(H)	12140	Data Transmissions
T23(V)	12170	Data Transmissions
T24(H)	12170	Occasional video

Loral Skynet Telstar 5

Ku-Band - 97 degrees West longitude

1(V)	11728.5	Data Transmissions / Bob Jones University Homesat (digital)
2(H)	11735.0	Data Transmissions
3(V)	11789.5	Occasional video
4(H)	11796.0	Data Transmissions
5(V)	11836.0	Pittsburgh International Telecommunications (PIT) (digital)
IRIB2 - Iranian / Al-Alam News Channel / Skylink TV - Chinese / Tamil TV (TVI usa) / Asia After Dark / Rang-a-Rang Channel - DC / Rang-a-Rang Channel - NY / Super Value Channel / Arabic Radio / World Service Radio / Quran Radio / Melli TV / Life Radio 1 / Khalifa TV News		
6(H)	11842.5	Data Transmissions
7(V)	11867.0	Globecast World Television (digital)
Assyria Sat TV USA / KBES-FM 89.5, Ceres, CA - Assyria Sat radio / Globecast / TV Romania / Fashion TV / National Broadcasting Network - Lebanon / AIT - African Independent Television / Qatar TV / Hi Tech TV / Global Marketing TV / ATV / Duna TV - Hungarian / BK TV - Serbian / Ray Power 106.5 FM - Nigerian		

8(H)	11873.5	Globecast World Television (digital)
Arab Network of America (ANA) / MBC (Middle East Broadcaster Centre) - Arabic / Arab Network of America (ANA) Radio - Arabic / Radio Dimensione Suono (RDS) - Italian / SPT (SIC International) - Portuguese / Al Jamahiriya Sat Channel - Arabic / Iraq TV / RTV-21 - Albanian / Radio 21 - Albanian / Futbol DP (Futbol de Primera) / Yemen TV / Radio Sanaa - Yemen		
9(V)	11898.0	"Sky Vista" (digital)
Nile TV International / Palestine Satellite Channel / Emirates Dubai Television - EDTV1 / Dubai Sports Channel - EDTV2 / Saudi Channel One / DISH Network International channels Promotional Channel / Beste Van Nederland (Dubai Business Channel) / Arabic radio		
10(H)	11904.5	Business Television (digital)
11(V)	11929.0	Globecast World Television (digital)
Euronews (languages: English, French, German, Italian, Spanish, Portuguese, Russian) / Syria Satellite Channel / Syria Radio / Al Manar TV / German TV / DW Radio - German / TV Polonia / Polskie Radio 1 / Polskie Radio 3 / SBC - Chicago-based South-Asian programming / Jordan TV / TVP3 - Polish		
12(H)	11935.5	Occasional video
13(V)	11960.0	Data Transmissions
14(H)	11966.5	Data Transmissions
15(V)	11991.0	Data Transmissions
16(H)	11997.5	Data Transmissions
17(V)	12022.0	Business Television (digital)
18(H)	12028.5	Data Transmissions
19(V)	12053.0	Occasional video
20(H)	12059.5	Data Transmissions
21(V)	12084.0	Taipei International Satellite Television (digital)
CTV - Taiwan / TTV - Taiwan / CTS - Taiwan / Taipei International Channel / Super Value Channel - Taiwan / Radio 1 / Radio 2 / Hunan TV / BCC-News / BCC-Pop / BCC-Taiwan / TAN - The Asian Network / Korean Radio / AFN Iran Radio - KIRN-AM 670, Los Angeles / MAC TV - Macarview TV - Taiwan Overseas Chinese Affairs Commission / Radio 7 / UCN TV		
22(H)	12090.5	ABS-CBN International (digital)
The Filipino Channel / ABS-CBN News Channel / Pinoy Blockbuster Channel / DZMM Radio Patrol / DWRR Radio Romance / NITV (National Iranian TV) / Zhong - Chinese / DA-1 - Tzu Chi Da'1 / Pars TV Network / Appadana International		
23(V)	12115.0	C Sky Net USA (digital)
ETV International / "TSI" radio / "USA-INFO" radio / BLTV - Buddhism Light TV / SET International - Sanlih Entertainment TV / Unique Satellite TV / JET-TV - Japanese Entertainment TV / Da-Ai TV - Tzu Chi Da'1 / BNE-TV		
24(H)	12121.5	Globecast World Satellite TV (digital)
Business TV 1: Assyria Sat (occ) / Globecast WTV promos (occ) / Hi Tech TV (occ) / Business TV 2: HRT - Hrvatska Televizija - Croatia (shares with HIC) / Business TV 2 HIC TV (Croatian Info Center Satellite TV - Hrvatski Informativni Centar) / Business TV 3: Sony / HIC Radio (Croatian Info Center Satellite TV - Hrvatski Informativni Centar) / DFH-1 - ATV and TBRT networks - Turkey / DFH-2 - Star Network - Turkey / DFH-3 - NTV, Kanal D, Telean networks - Turkey / KISB 1 - Korea International Satellite Broadcast channel 1 / KISB 2 - Korea International Satellite Broadcast channel 2 / KISB 3 - Korea International Satellite Broadcast channel 3 / DFH-FM 1 - Turkish radio channel 1 / DFH-FM 2 - Turkish radio channel 2 / IP Service / Radio Korea / Mcast DTH		
25(V)	12146.0	Occasional video
26(H)	12152.5	Globecast World Satellite TV (digital)
Abu Dhabi TV (EMI) - Arabic / Emirate FM - Arabic radio / Azadi Television / IPN - International Programming Network / Iran TV / Tapesh TV - Iranian / Ajara - Georgian / Radio Sedaye Iran (KRSI Los Angeles area) / Radio Seoul - live from L.A. / Thai TV 5 / JII TV - Iranian (Farsi) / Persian TV Channel One / Armenian Public TV / Bahai Radio / WVGW Radio, 107.3 FM Charlotte Amalie, Virgin Islands		
27(V)	12177.0	Pittsburgh International Telecommunications (PIT) (digital)
KurdSat / Kurd TV / KSMI radio - Radio Sedaye Melli Iran / Maharishi Open University / KIRN-AM 670 - Radio Iran / VTV4 / Samanyolu TV World / World Radio Network 1 - English / World Radio Network 2 - Multilingual / World Radio Network 3 - French / Kuwait Radio Network / Kuwait Space Channel / Back-to-Health TV / Israeli TV / Pro TV International / PIT Adhac services / Infomercials / TRT - Turkish Radio-TV Corp.		
28(H)	12173.5	Spacecom Systems FM Squared / FM Cubed Services
Data Transmissions .10, .23, .30, .35, .38, .50, .65, .77, .89, .96, 1.05, 1.12, 1.22, and 1.35 MHz		

Reader News and Loggings

Gary Timm (WI) sent along an interesting news clipping from the December 2002 issue of *Radio World*, a trade journal for the broadcast industry. *A Solution to Low-Power Problems* is an article that discusses the need for public access to the airwaves. The writer, William Walker, suggests that under-utilized longwave frequencies be explored for AM broadcasting in the U.S. in addition to new low power assignments in the AM Expanded Band.

Mr. Walker advocates both licensed and license-free assignments on longwave and cites low interference and improved coverage as the major benefits to his plan. As for critics' concerns that not enough people have LW receiving capabilities, he points out that the public bought new radios when FM broadcasting became popular, and they are doing the same thing now with the advent of HDTV. Longwave allocations, he argues, would provide a legitimate outlet for would-be pirate operators or others who desire access to the broadcast frequencies on a limited budget.

◆ Scannists Welcome, Too!

MT's *Scanning Canada* columnist, John Corby (VE3KOT) did some exploring below 500 kHz and came up with the list of loggings shown in Table 1. For LF work, he uses an Icom 725 ham transceiver with a shortened G5RV wire antenna. In two hours of monitoring, he managed to log 19 beacons, mostly from southern Ontario, but also three from the U.S. including Puerto Rico. John is located atop the Niagara escarpment in Southern Ontario, Canada (grid square EN93).

He notes that many Canadian beacons are still using single-letter IDs, despite our announcement of a conversion to the 3-letter format. According to *Below 500 kHz*' Canada advisor, Jacques d'Avignon, the conversion to 3-letter IDs is an ongoing process. Jacques reports that the Southern Ontario beacons will likely be among the last to be converted, with changes occurring in 6-week intervals to match the issuance of the *Canada Flight Supplement*. We will report here on any changes to the situation.

◆ New LF Product

The folks at Ramsey Electronics (<http://www.ramseyelectronics.com>) have announced the release of the VLF1, a Low Frequency Converter kit for use

Table 1. Beacon Loggings by VE3KOT

FREQ. (kHz)	ID	LOCATION
216	CLB	Wilmington, NC
221	HM	Hamilton, ON
236	J	Toronto, ON
257	TZ	Gibraltar Point, ON
263	YGK	Kingston, ON
266	B	Hamilton, ON
268	S7	Hanover, ON
272	YQA	Muskoka, ON
326	VV	Warton, ON
335	K	Waterloo, ON
341	T	Toronto, ON
344	CL	Cleveland, OH
356	YZD	Downsview, ON
368	L	Toronto, ON
385	X	Toronto, ON
390	OO	Oshawa, ON
391	DDP	San Juan, PR
397	A	Hamilton, ON
403	R	Toronto, ON

with shortwave receivers. The VLF1 receives frequencies below 400 kHz and electronically moves them up to 4 MHz. This means that to hear a beacon on 344 kHz you would tune your SW receiver to 4.344 MHz. The kit runs on 12 volts DC, and includes a 7-pole low pass filter to minimize interference and overload that can sometimes occur from nearby AM stations.

If you have an older shortwave-only receiver or ham rig and would like to explore the longwave band, this kit may be an ideal solution. It is also an easy kit to build and would be a great way to learn more about electronic construction. One note of caution

for those planning to use an LF converter with a ham transceiver: Be *certain* to disconnect the microphone and/or key to prevent accidentally transmitting into the converter. Such a mistake would likely cause permanent damage to the device.

The basic price for the VLF1 is \$34.95. Visit Ramsey's web site for more details on this new product. You will also find a variety of links to other LF-related web sites on the VLF1 page.

◆ Online ID Tool

Jim Hannah (Staten Island, NY) writes with a useful tip for those seeking to get a better fix on the locations of beacons they hear. Sometimes, FAA beacons will be identified with only a "name," not the actual town or city of the station. A case in point is OGY/414 kHz. It is listed in some publications as "Bridge NDB, NY, NY." The name "Bridge" does not give you much information, but the listing also includes geographic coordinates, which are useful, if you know how to use them.

In the old days (i.e., pre-Internet/pre-GPS) you'd need to obtain a U.S. Geologic Survey map of the area and cross reference the coordinates to get an exact fix for the station. Now, several online tools can do the job for you. Jim found an especially useful site at: <http://www.artsipub.com/repeaters/mapatlong.asp>. After entering the coordinates, a detailed map appears, and it allows you to zoom in on the image to pinpoint the location. Jim notes that the site appears to be limited to U.S. and Canadian locations, but is a very useful tool for serious DXers.

◆ New BeaconFinder Available

The *North American BeaconFinder* directory has been completely revised for 2003. In addition to many U.S. updates, the 2003 guide includes a new database of Canadian, Mexican, and foreign beacons that are commonly logged in North America. Copies of the guide are available for \$13.95 postpaid (check or M.O.). Orders for the guide may be sent to: Kevin Carey, P.O. Box 56, West Bloomfield, NY 14585. Purchasers of earlier versions of the *BeaconFinder* are eligible for a \$4.00 discount. To claim the discount, simply return the front cover of your original *BeaconFinder* when you order.



The Ramsey VLF1 is a receiving converter for the frequencies below 400 kHz.

Ham History through the Handbook

Back when I wrote the *Beginners Corner* for *Monitoring Times*, I developed the tradition of doing a book review column every April. Since moving over to the *On the Ham Bands* column, I have deviated somewhat from this practice. However, as spring is sprung, I feel the need to wax nostalgic, not just for the way I used to write my April column, but for the history of our great ham radio hobby.

We have a rather unique hobby in that, believe it or not, there are still a few folks around who go all the way back to the beginning when Marconi first tapped a key. If you ever run across one of these living treasures of amateur radio, make a point to spend some time hearing their stories. They have seen a lot happen in the radio hobby as they moved from spark gap to surface mount technology.

Another old friend who has been around nearly as long is *The Radio Amateur's Handbook*, *The Standard Manual of Amateur Radio Communication*, published continuously since 1923 by the staff of The American Radio Relay League. I have even met one or two of those living treasures who actually purchased every volume through the years for their personal use.

Although I have bought the *Handbook* most years since I first decided to get my li-

cense (my first copy was the 1975 edition) I've never actively collected old copies of the *Handbook* intentionally. However, a few older issues have come my way over the years and I often like to take them down off the shelf and get a look at how ham radio was done some time back. While none of them go back so far as to show me how to build a spark gap transmitter, they do cover a lot of ground that most readers can relate to.

◆ 1960

For instance, somewhere I came across a pristine copy of the 1960 *Handbook*. Think of it in an historical context – The whole *New Frontier* idea. Advancing technologies and talk of space travel. As hobbies go, amateur radio was just the ticket. I get goose bumps when I flip through the pages.

The first thing you notice is the cover price of \$3.50, less than one tenth of the current edition. You also discover that the ARRL HQ was then located in West Hartford, Connecticut, instead of its present-day Newington. You could take your Novice, Technician and General class exam by mail with the help of volunteer examiners, although a mailed-in General test got you a "Conditional" license. Hams had to worry about something called *Conelrad Compliance*.

What is also striking is how much of the information inside its covers is still pertinent today. Ohm's law hasn't changed. Frequency and wavelength calculations are the same, but we now talk in terms of *Hertz* instead of *Cycles*. Most of the basic theory is still found in the latest edition. Many basic antenna designs go way back and still hold true. Courteous operating practice has always been an amateur radio standard of excellence and also has not changed significantly over the years.

In 1960, ham radio meant vacuum tubes everywhere, even for VHF and UHF work. The book has a scant four pages of information on these new fangled transistor thingies. One of the very few practical transistor circuits presented is for a 25-watt modulator for use in mobile operation. Oh... Yeah... Modulators... If you were going to play ham radio in 1960, the majority of folks were still using AM as the primary voice mode of voice transmission. Single Sideband (SSB) was still new to ham radio and, in many quarters, very controversial. Find an Old Timer and ask him about the *sideband wars*.

But back to tubes. Some of the designs in this old handbook would still be fun to build.

There is a neat "Novice" transmitter using a 6DQ6A pentode and a more powerful 50-watt rig using the venerable 6146. On the receiving end of things there are a couple of three and four tube "Superhets" that look like they would be tons of fun to build. I think a neat challenge would be to scrounge the parts, assemble and operate with a classic 1960 Novice station.

Something of a lost art in most ham circles is getting your existing gear to operate on additional bands by use of converters. This old *Handbook* is full of designs for extending your frequency range.

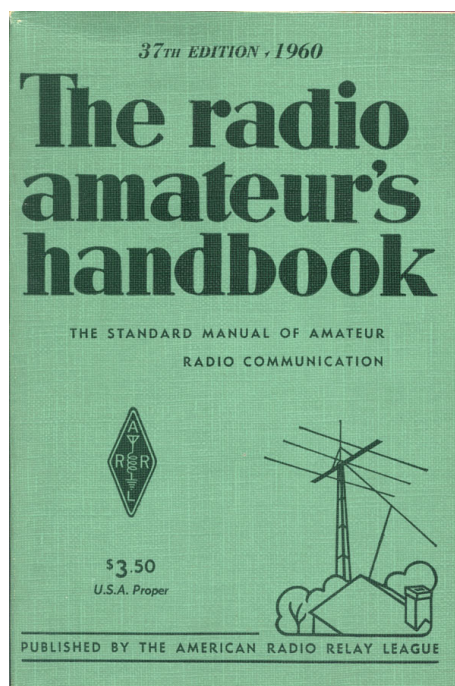
Speaking of frequencies, keeping your gear within the limits of the amateur radio spectrum was quite a challenge back in the '60s. You would be taking a real chance if you tried to get on the air without having a secondary frequency standard to keep things on the up and up. The *Handbook* showed you how to build one using a 6AU6 tube.

Mobile operation from the sixties looks amazing. The gear was obviously fairly large and serious power meant looking into devices such as dynamotors and multivibrator power supplies. You can get by in ham radio today without ever knowing what these two devices are, but it is sure fun reading how things got done back in the days of the *New Frontier*.

◆ 1975

Fast forward fifteen years. I now take down off my shelf the first edition of the *Handbook* I bought in preparation for studying for my first ham exam. While it was my first edition, it was the League's fifty-second. In the 1975 edition, priced at a whopping \$5.50, transistors have largely replaced tubes except in the higher power amplification stages. High wattage RF transistors were in existence but were cost prohibitive and not very durable. That was still a few years down the road. By this time you were even finding good integrated circuit designs and projects, even though most of us were still scared to work with them. Kind of like those old tube folks were around transistors.

What did begin to appear in *Handbooks* of this era were wonderful construction projects by MT's late, great Doug DeMaw W1FB (or W1CER as he was known back then). Doug's designs were novel and inexpensive. They always made use of parts that were easily obtainable at that time. The circuits still have a lot of life in them and I would commend them to anyone who likes to build their own receivers



and transmitters. While some people call today the *golden age* of QRP operation, Doug's and other projects in the *Handbooks* of the mid-seventies were the real root designs of everything that has come since in low power operation.

The middle 1970s were also the *golden age* of 2 meter FM repeaters and mobile operation. The *Handbook* had it all. Repeater designs, rig designs, antenna designs, even ignition noise suppression designs. Automobiles, even into the seventies, were still not the most friendly environments for playing radio.

You could even learn how to play with the now practical amateur satellites. OSCAR 6 was going strong and could be worked with relatively modest equipment. One way to get there was to build one of the *transverter* designs out of this edition of the *Handbook*. This allowed you to get your 10 meter rig to transmit on the 2 meter uplink while listening on the 10 meter downlink.

Another project dear to my heart from that *Handbook* was the *Accu-Keyer*, a simple, yet full-featured keyer design that would still be a lot of fun to use today. Many ham clubs back then used the Accu-keyer as a group project for getting folks to understand how to work with ICs.

Something was missing from the 1975 *Handbook*. It was right after 1975 that the "shoe dropped" and personal computers, in their most rudimentary form, began to be part of any electronics hobbyist's world. The 1975 *Handbook* was the calm before the storm that would transform how most people would play radio from then on out.

They say you never forget your first love. Hams say they never forget (or part with) their first *Handbook*.

◆ 2003

So where are we now? Just what does that cover price of \$34.95 bring to the table? As in every edition prior, the reader gets a one-stop resource for every possible aspect of the amateur radio art. Current handbooks not only mention computers, they integrate personal computing into almost every aspect of the hobby. New modes of digital communication such as PSK-31 show how far we have come since the 1975 *Handbook* mentioned above. All the basic theory is still there. But now the *Handbook* speaks to design concepts such as digital signal processing, devoting an entire chapter to this world-changing electronic concept.

Electronic components have moved on, too, and it is no surprise to find thorough studies of surface mount technologies (SMT) and construction techniques. And now, the only tubes to be found are in the legal limit amplifier designs; transistors are the order of the day well up past the average hams 100-watt exciter.

Back in 1960, the study of RF radiation and signal propagation took up a scant six pages. Now a 25-page chapter barely scratches the surface of this complex subject. This is because of so many recent developments in our understanding of solar radiation and the Earth's magnetic field. You see, since those heady days of

the 1960s, we got up into space in a big way, and one of the payoffs of conquering that higher ground was the basic propagation knowledge that helps contemporary hams every day.

Alternate power sources such as solar cells have been understood for years, but the costs have only recently come down to the point that an all-solar-powered station is a realistic option for any dedicated amateur radio operator.

Something else I noticed as I moved through the years was a growing emphasis on both safety and interference reduction. Since those early days, we have learned how to take care of ourselves and be good neighbors, too.

◆ The Future

What will the *Handbooks* of the future offer to us? You can expect further movement in digital signal processing and new reliable digital communications modes that will further reduce bandwidth in the crowded radio environment. Digital voice communication will come on very strong in the near future. With amateur satellites, the sky is not even the limit anymore! *Handbooks* of the future will continue to hold the ideas that will excite and inspire the amateur radio community. And even with a cover price ten times that of my old 1960 edition, the ARRL *Handbook* remains the best bargain in the ham radio hobby.

Why not start your own ham radio tradition? The current 80th edition ARRL *Handbook* can be had in hardcover for \$49.95 (\$8.00 S&H), softcover for \$34.95 (\$7.00 S&H) or on CD-ROM for \$39.95 (\$5.00 S&H) from the American Radio Relay League, 225 Main Street, Newington, CT 06111-1494, 1-888-277-5289. <http://www.arrl.org/shop>.

Have Fun. I'll see you on the bottom end of 40 meters.

Outer Limits continued from page 69

NY 14711; PO Box 28413; Providence, RI 02908; PO Box 293, Merlin, Ontario N0P 1W0, Canada; PO Box 9, 8096 ZG Oldebroek, Netherlands; and PO Box 69, Elkhorn, NE. Some pirates prefer e-mail, bulletin logs or internet web site reports instead of snail mail correspondence. The best bulletins for sending pirate loggings with a hope that pirates might QSL them remain *The ACE* (\$2 US for sample copies via the Belfast address above) and the e-mailed *Free Radio Weekly* newsletter, still free to contributors via niel@ican.net. The Free Radio Network web site, another outstanding source of content about pirate radio, is found at <http://www.frn.net> on the internet.

◆ Thanks

Your loggings and news are always welcome via 7540 Highway 64 W, Brasstown, NC 28902, or via the e-mail address atop the column. We thank this month's valuable contributors: John T. Arthur, Belfast, NY; Artie Bigley, Columbus, OH; Ross Comeau, Andover, MA; Rich D'Angelo, Wyomissing, PA; Bill Finn, Philadelphia, PA; Harold Frodge, Midland, MI; William Hassig, Mount Prospect, IL; Harry Helms, San Diego, CA; Jeffrey Hodgins, Virginia Beach, VA; Chris Lobdell, Stoneham, MA; Greg Majewski, Oakdale, CT; Bill McClintock, Wellington, OH; **Craig Pradarelli, Milwaukee, WI**; Lee W. Minnick, Colorado Springs, CO; Mike Prindle, New Suffolk, NY; Lee Reynolds, Lempster, NH; Walter Salmani, Victoria, British Columbia; Martin Schoech, Merseburg, Germany; John Sedlacek, Omaha, NE; Lee Silvi, Mentor, OH; Woody Smith, Knoxville, TN; Peter D. Vieth, Richard Weil, Minneapolis, MN; Dave White, Hermitage, TN; Bob Wilkner, Pompano Beach FL; and Niel Wolfish, Toronto, Ontario.

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Michigan QSO Party Apr 19 1600 UTC—Apr 20 0400 UTC	
Ontario QSO Party Apr 19 1800 UTC—Apr 20 1800 UTC	
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Capturing and Keeping Radio Signals

For reception of strong signals, most any antenna will give satisfactory reception. But, if we want to receive weak signals, it's good to know some of the things antennas can do to help.

❖ Antenna Apertures

First let's think about an antenna as it collects power from an incoming radio wave, and about a fictitious area called the antenna's "collecting aperture." What makes the aperture fictitious is that the size of an antenna's collecting aperture may not be at all close to the actual physical size of the antenna! For example, the actual physical size of an antenna with a collecting aperture of one square meter might be equal to, or much, much less than one square meter!

An antenna's collecting aperture is a measure which relates the amount of signal power actually collected by the antenna to the area of signal wave front required to produce that amount of power.

Let's say that the incoming wave front has a field strength of 10 milliwatts per square meter. An antenna which has a collecting aperture of one square meter will collect 10 milliwatts from the passing wave. If the antenna has a collecting

aperture of two square meters it will collect 20 milliwatts from the passing wave, and so on. In any case, it is the amount of power which the antenna does collect, not the antenna's physical size, which determines the size of its collecting aperture.

An antenna's collecting aperture, which is sometimes referred to as its "capture area," is subdivided into three smaller apertures which, like the collecting aperture, are all fictitious areas. One of these is the "loss aperture." The loss aperture is the portion of the collected signal which is wasted as heat in the resistance of the antenna's elements. We can reduce this loss by reducing the resistance of the antenna's elements. For instance, we can make the elements larger or of more conductive material such as aluminum, copper or silver.

It is very impressive to witness the performance of antennas with low element-resistance such as the small, low-resistance loops. The elements for these loops are usually made of copper or aluminum tubing or straps. These small antennas can equal the performance of a full-sized, halfwave dipole in signal output. However, they must be retuned frequently as frequency is changed. This retuning is necessary

because reducing the resistance of the antenna's elements so much also makes the antenna much more sharply tuned: its bandwidth is dramatically reduced. If you want your antenna to respond well to a broad band of frequencies without retuning, this reduction is undesirable.

Interestingly enough, a portion of the signal collected by an antenna is reradiated back into space as radio waves. The amount reradiated determines the size of the "scattering aperture." Generally speaking, there is little to be done to reduce this scattering; however, it is possible to cause some of the scattered waves to return to the element from which they were scattered! Parasitic beam antennas (e.g., Yagi-Uda, cubical quad) do this by using reflector and/or director elements.

The amount of collected signal remaining after subtracting loss due to element resistance, and loss due to scattering, is known as the antenna's "effective aperture." This is the amount of signal routed toward the receiver from the antenna's feedpoint.

❖ Directivity and Gain

One way to enlarge our antenna's collecting aperture is to utilize an antenna with more

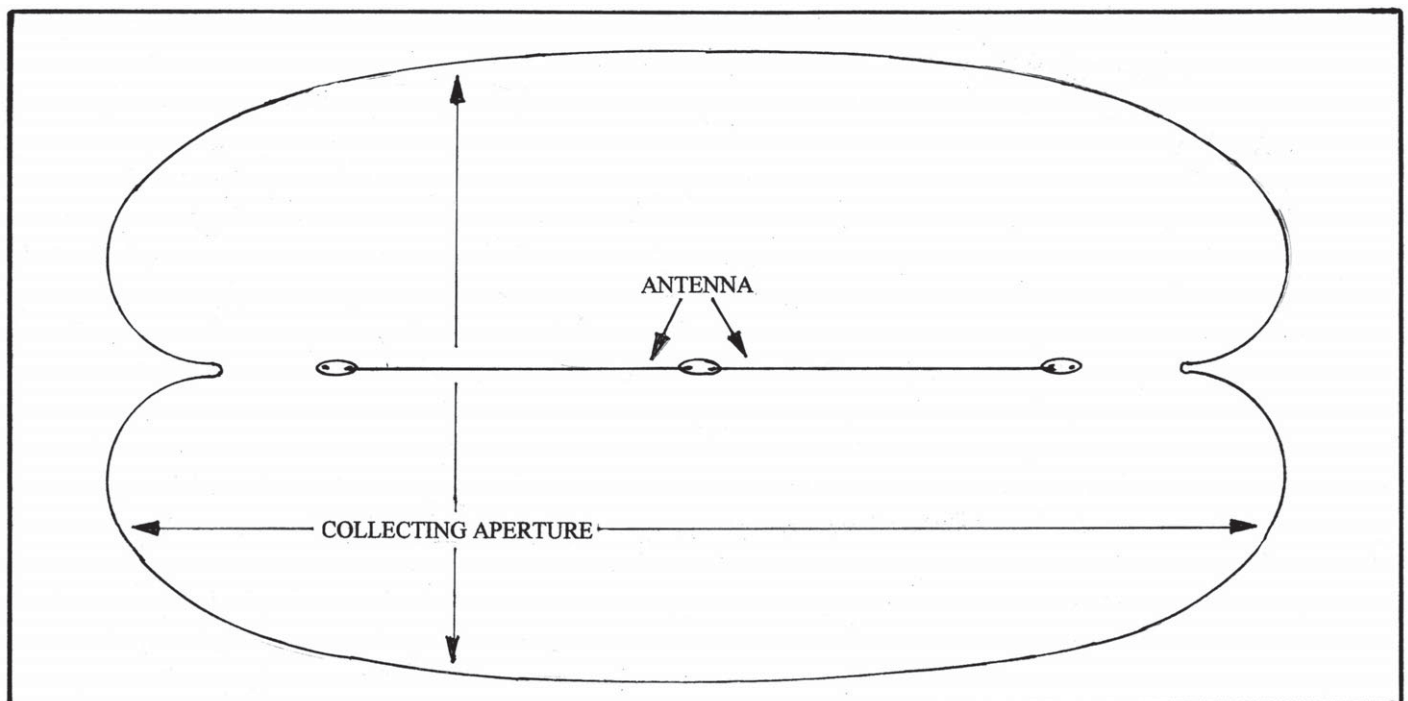


Fig. 1. One way of conceiving of the collecting aperture of a halfwave, horizontal dipole antenna. Note that the collecting aperture can sometimes be immense compared to the antenna's physical size.

This Month's Interesting Antenna-Related Web site:

For an interesting look at diversity reception try -

<http://www.radioblvd.com/DiversityDD1.html>.

gain. Gain is a relative measure of the signal output of an antenna as compared to some reference antenna. Under identical circumstances antennas with higher gain have greater signal output than those with less gain.

When an antenna is designed to have high gain, it is somewhat as if the antenna's reception pattern were a balloon: when we squeeze it in at one place, it balloons out farther in other places. And so the manner in which we "squeeze" our antenna design determines the reception pattern we get. The resulting pattern leads to increased directivity in some compass directions or at some vertical angles, and less in other directions and at other angles.

So, if we use an antenna of higher gain we capture more power from signals coming from the direction of the antenna's maximum responsiveness, and reduce power captured from signals coming from other directions. Obviously then, when we increase antenna directivity we decrease its response to signals, such as interference and received noise, coming from directions other than those favored by the antenna's directivity.

At HF and lower frequencies, this reduction of interference and noise is often more important for improving reception than is increasing signal strength of the desired station. At VHF and higher frequencies, where received-noise is less of a problem, increased signal strength is likely to be more important.

◆ Antenna Siting

Even the best antennas cannot receive signals to which they are not exposed. Old timers have a rule that you should put your antenna high and in the clear if you want to capture more signal. That's still a good rule if you can manage to do so. Objects such as hills, metal buildings, buildings containing lots of wiring and metal, or heavy vegetation may block signals from reaching your antenna.

It's obvious that with directional antennas the major lobes of the reception pattern should be oriented in the compass direction of the desired incoming signal. It's also true that for best reception the major vertical lobes of the antenna's reception pattern must be aligned with the vertical angle of the incoming signal's arrival (angle with respect to the earth). The type of antenna utilized, its orientation with respect to the earth, and its height above earth are all factors that can help us obtain a reception pattern with the appropriate vertical angle to capture the signals we want.

Polarization refers to the orientation of the electric field in a radio wave, and to current flow in the antenna which deals with the wave. For best reception it's important to mount an antenna such that it is polarized in the orientation that is expected from the incoming signals. If incoming-signal polarization is expected to vary,

then it may be desirable (but expensive) to consider polarization-diversity reception. Space diversity reception (spatially separated antennas) may help keep signal strength to useful levels if the received signals tend to fade. Diversity systems utilize multiple antennas (differently polarized antennas, or spatially separated antennas) from which the strongest signal is automatically selected electronically (see *This Month's Website*).

Rays, or portions of a signal from a transmitting antenna, can take different paths to reach the same receiving antenna. Some paths are straight line-of-sight (LOS). Other paths are crooked path due to reflecting from the earth, or other objects: they are longer than the direct, LOS path. If some paths happen to be a half wavelength different than the LOS path, then those two rays tend to cancel one another, and received-signal strength will be reduced. This can cause "dead spots," or locations where signals fade away. This is most noticeable at VHF and higher frequencies. Due to this effect, you may be able to improve signal capture by shifting your antenna around to find a spot to put it where the desired signal's rays add rather than cancel. Space-diversity reception is another solution.

◆ Matching

Obviously, we want to deliver to the receiver the maximum signal power available from the effective aperture. To do this we must impedance-match the antenna's feedpoint to the feedline, and the feedline to the receiver. At HF this is often not too important for decent reception, but at VHF and higher frequencies it can be very important.

◆ And So,

Selecting an antenna system for weak-signal reception obviously requires some thought. A good source of information to help you in this job is the ARRL *Antenna Book*. It covers both theory and practical application. It is available through most radio supply houses: for used copies check eBay.



Last Month:

I said "For point-to-point communications is it ever possible to have too much gain or directivity?"

Well, in general, increasing gain or directivity gives the antenna pattern a more narrow main lobe. And, because of variations in the earth's ionosphere, the path which a signal takes from transmitting antenna to receiving antenna may vary somewhat. This can lead to the incoming signal "wandering around" a bit at the receiving location.

If the major lobe of either the receiving or transmitting antenna is too narrow, then the signal may wander out of the receiving antenna's collecting aperture. Then, when the two lobes

no longer overlap, reception of the desired signal is impossible.

This Month:

Let's say that we put a halfwave dipole, cut for 150 MHz, on top of a hill, but we never connect anything to it! It is just a half-wave-length long piece of aluminum tubing on a wooden pole at the top of the hill. Have we totally wasted our time and material, or could this possibly be of some use to us in our radio communications?

Hint: say that we live in a small valley below the hill, and a 150 MHz radio station we want to monitor is on the other side of the hill from us.

You'll find an answer to this month's riddle, another riddle, another antenna-related web site or so, and much more, in next month's issue of *Monitoring Times*. 'Til then Peace, DX, and 73.

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A Short History of Vacuum Tubes

By the end of last month's column, we had completed the electrical restoration of the Zenith 6S229 "black dial" broadcast/short wave radio. But I haven't yet done my homework on locating a proper dial glass and carrying out some cabinet repair. So I thought this might be a good time get off the restoration track for a moment and go over some basic antique radio information. Specifically, I'd like to talk about how the physical appearance and nomenclature of vacuum tubes evolved over the years.

The first tubes widely used in the broadcast receivers of the early 1920s employed much of the technology of the light-bulb industry and, not surprisingly, had the light bulb's typical pear-shaped envelope with the air evacuation tip coming to a point at the top. However, there were a few types with cylindrical glass styles. A few years later, paralleling the changes in light-bulb design, the tip would be moved to the bottom of the bulb, protected inside the base.

◆ Early Tube Bases

Like light-bulb bases, the first tube bases were made of brass. However, the light bulb required only two contact points for its filament, while tubes needed four to accommodate not only the filament but two additional elements: the grid and plate. So instead of the light-bulb's two-contact screw base, the tubes had four stubby contact pins emerging from the bottom. A metal locating/locking pin protruding from the side of the base made it possible to bayonet-mount the tube in its socket similar to today's auto turn signal or tail light lamps.

By the mid-1920s, tube base material changed from brass to the less expensive and easier-to-shape Bakelite. About the same time, the tube pins were lengthened so that they could slip down through matching holes in a simplified socket equipped with spring-metal wiping contacts. For a time, the locating/locking pin was retained so the long-pin tubes could still be used as replacements in the old-style sockets.

Towards the end of the 1920s, a metal "grid cap" appeared atop the envelope of a couple of new tube types. This was used for the tube's *control grid*, moved to this location to free up a base pin for an additional element – the *screen grid* – that made possible a higher degree of amplification without danger of feedback and oscillation. A bit later a second base style with five pins was introduced for tubes incorporating yet a new element, the *cathode*, that made it possible for tube filaments (called *heaters* in this application) to operate from alternating current from the a.c. line instead of battery power. Still later, these bases sprouted additional pins to accommodate later tubes of more complex design.

Evolution of the Tube Envelope

In the 1930s, the envelope changed from pear-shaped to the familiar double-curved shape technically known as the "ST" style. A little later in the decade, thanks to more compact tube designs, many new tube types (and some older ones) were released in a straight-sided, rounded-top envelope (the "GT" or "Bantam" style) that was much shorter than the previous designs.

◆ Evolution of the Tube Envelope

Metal-shelled tubes, having roughly the same shape and dimensions as the "GT" types, also appeared. These become available from many manufacturers as an alternative to the glass versions. A major advantage of this type was its self-shielding feature. The external shield assemblies required by

glass tubes in certain critical applications were not required.

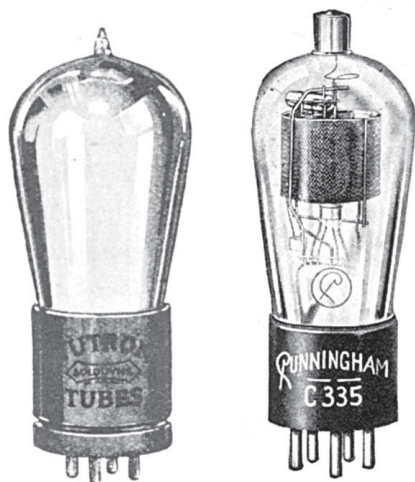
◆ Octal and Loktal Bases

During the mid-1930s, parallel with the development of "GT" and metal tubes, the octal (8-pin) base was introduced. It was required to accommodate the greater number of electrical connections required by still more complex tube designs. The base was equipped with a central guidepost having a molded-on positioning key. Inserted into a mating opening in the tube socket, the post effectively prevented the tube from being inserted in the wrong orientation.

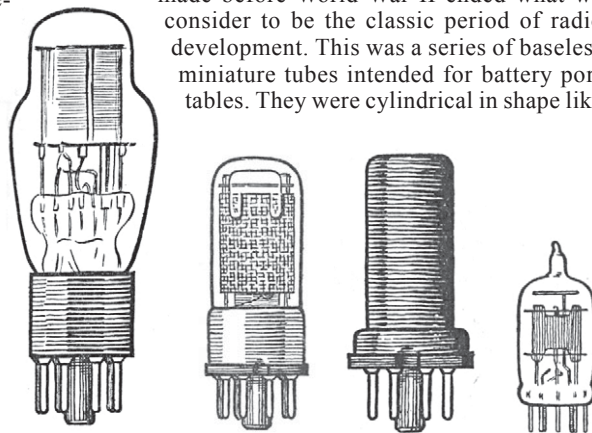
In order to compete with the octal base (patented by RCA), arch rival Philco developed its own version, the *Loktal*, in collaboration with Sylvania. Actually, the Loktal did not have a base at all in the usual sense. What looked like a metal base was just a shell surrounding the lead-in wires emerging from the bottom of the tube. These wires had been made heavier to serve as contact pins.

The shell included a center post with a locating pin similar to the one on the octal base. A spring-like device mounted on the bottom of the tube socket snapped into a groove in the center post. This was a largely unnecessary feature that was supposed to provide positive locking for the tube – but was probably included mainly to improve Philco's chances of receiving a patent. Once introduced, Loktal tubes were used in virtually all Philco radios.

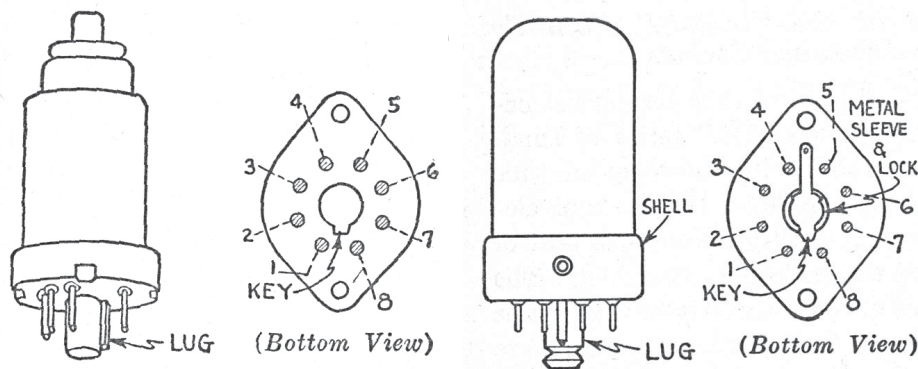
The Loktal design may have contributed to the last innovation in tube construction, made before World War II ended what we consider to be the classic period of radio development. This was a series of baseless miniature tubes intended for battery portables. They were cylindrical in shape like



At left, early-20s tube with tip seal, brass bayonet-lock base and stubby pins. At right, late 20s tube with grid cap, Bakelite base and long pins.



From left: tube with "ST" envelope; tube with "GT," or bantam, envelope; metal tube and miniature tube.



At left: octal tube with socket; at right, loktal tube with socket.

the "GT" types, but significantly shorter and smaller in diameter.

As in the Loktal design, the tube pins were actually the lead-in wires emerging from the glass bottom. Since there was no base to protect it, the evacuation tip was moved back to the top of the tube, where it had been in the early days. After the war, this type of envelope began to be used more widely – even on non-portable types and eventually all but replaced the "GT" style.

❖ Tube Nomenclature

At first, a serial numbering system was used, with the basic type number carrying a prefix (one or two letters and a number) assigned by the manufacturer. For example, the UV-201 made by RCA and Cunningham's C-301 were both "01" tubes identical in design.

RCA's letter prefixes referred to the style of tube base (for instance, "UV" was used for the original short-pin, bayonet-mount base and "UX" designated the later, long-pin base). Eventually the RCA letter designations came to be used generically in referring to the style of a tube base – regardless of the manufacturer. But about 1930, the "manufacturer's prefix" was dropped from the type numbers, and such tubes as the UX-280 and UV-201-A became simply types 80 and 01-A.

As the number of tube types began to proliferate during the 1930s, the serial numbering system became inadequate and a more sophisticated system replaced it. In the new system, a tube number contained three designators: (1) the filament or heater voltage of the tube; (2) a letter related to the tube function, chosen from the early part of the alphabet for amplifiers and from the later part for rectifiers; (3) a number indicating the number of active elements in the tube.

Good examples are the 6C6 and the 5Z3; the former being a 6-volt amplifier containing six active elements (filament, cathode, three grids and a plate); the latter a 5-volt rectifier with three active elements (a filament and two plates). Tubes with similar construction and functions but different operating characteristics are the 6D6 and 5Y3.

Where the same tube was available either in the double-curved ("ST") style or the bantam ("GT") style, an identifying suffix was often added to the tube designator: "/G" for the "ST" style and "/GT" for the bantam

style. Later developments caused further modifications to the system. When the top cap connection on some tubes was replaced by a pin connection on the base, an "S" (for "single-ended") was added to the type number of the tube. For instance, the single-ended version of the 6J7 was called "6SJ7."

Another variation on the system is the designation assigned to the Loktal style tubes. To indicate their special base design, Loktals bore type numbers beginning with "7," even though they had standard 6-volt heaters. Of course, other modifications and inconsistencies too numerous to mention here crept into the system over the years.

❖ Reader Needs

Marty Brunet ("martin brunet, jr" uxma@msn.com) is looking for a copy of the manual for a Simpson 383A capacohmmeter. Gerald L. Park, W8QS ("gerald park" park@egr.msu.edu) is missing the "C" coil needed to complete the general coverage coil set for his National HRO 60. He's also looking for the XCU50-2 crystal calibrator. Gerry has an original HRO 60 manual which he'd probably be happy to copy as part of the deal.

Kenneth Pietrucha, WA2OKZ, is trying to help a friend who just restored a Sears Silvertone Model R101. The set's chassis is designated 101.614 and is also used in Models R81 and R1171. The dial cord is broken and they need a reference to restring it. There are five small pulleys in the drive system, so the scheme is not exactly intuitively obvious. Contact "Kenneth Pietrucha" wa2okz@yahoo.com.

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Audio and Visual Amplification

GRE, which stands for General Research of Electronics, has been the major manufacturer of scanners for Radio Shack for over 30 years. I bought my first GRE receiver in 1971, a Realistic PRO-2B VHF-high/low monitor.

You won't see the GRE name displayed on the outside, but the circuit boards are usually labeled "GRE" or "GE" inside. The GRE heritage is clear to anyone who has researched scanner patents, because many of them are assigned to GRE. (Read about scanner patents in June 1997 and February 1998 *MT*.)

GRE Super Amplifier

The Super Amplifier is one of the few hobby products that GRE markets under its own name in North America.

As the brief instruction sheet indicates, the GRE Super Amplifier is a broadband amplifier "designed specifically for handheld scanners." I found the Super Amplifier useful with RF test equipment like a spectrum analyzer and frequency counter. The amount of gain is adjustable via a small potentiometer.

The amplifier is powered by an ordinary 9 volt battery and I measured an 18 mA current drawn. An optional 9 VDC power supply may be used instead. The external power connector center pin has a negative polarity. I installed a 9 volt alkaline battery and tried the Super Amplifier on a variety of scanners, test gear, and antennas.

Performance with an Indoor Antenna

The Super Amplifier made several weak signals on my Yaesu VR-500 and Radio Shack PRO-92 more understandable when used with a rubber insulated helical antenna. However, there were instances in which energizing the amplifier produced spurious signals.

I measured the improvement in sensitivity when the Super Amplifier was used with my PRO-92. The accompanying graph shows a plot of the PRO-92 alone and the PRO-92 when connected to the Super Amplifier. The amplifier was completely disconnected in the former case to avoid the small signal loss in the bypass position, a phenomenon I will discuss later.

The Super Amplifier extended the range of my HP frequency counter when using a telescoping antenna. I was able to obtain a stable frequency display from further away

when transmitting at 145 and 445 MHz from a 300 mW walkie-talkie.

Performance with an Outdoor Antenna

This product is intended for use between a portable scanner and a small antenna, but I tried using it with an outdoor antenna just to see what would happen.

As might be expected, the Super Amplifier overloaded when teamed with an ICOM IC-R8500 tabletop receiver and a full size, outdoor AV-801 antenna. Signals from a local 91.9 MHz FM broadcast station appeared on 173.65 MHz



television intermodulation appeared on 163.5 MHz.

It improved some weaker 460 MHz signals, but raised the noise level as well.

I live in a rural/suburban setting and those who live in an area with fewer transmitters may not experience the same overload problems when using the Super Amplifier with an outdoor antenna.

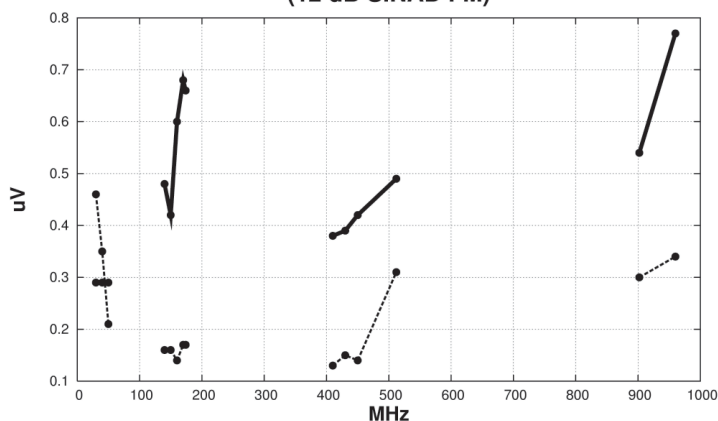
The Super Amplifier did a good job of amplifying signals when connected between an HP spectrum analyzer and outdoor antenna. I could see signals on the analyzer when the amplifier was on which were too weak to see without it.

Loss When Bypassed

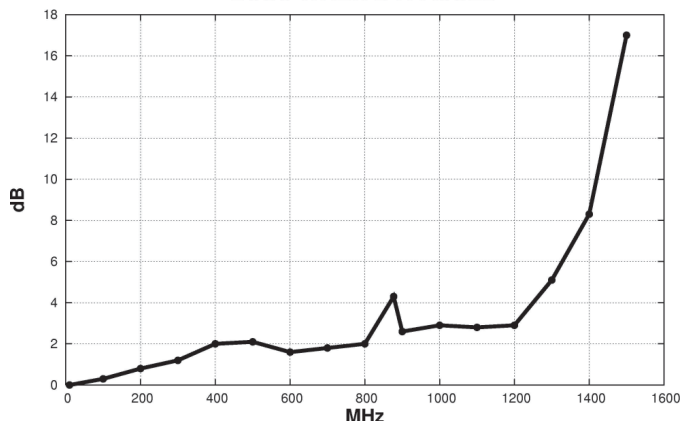
The Super Amplifier has a small slide switch which removes power from and bypasses the amplification circuitry. There is some signal loss incurred by leaving the Super Amplifier connected between antenna and receiver even when the switch is kept in the "bypass" position. The loss is due to the switch itself, the BNC connectors, the circuit board, and the wiring between the circuit board and connectors.

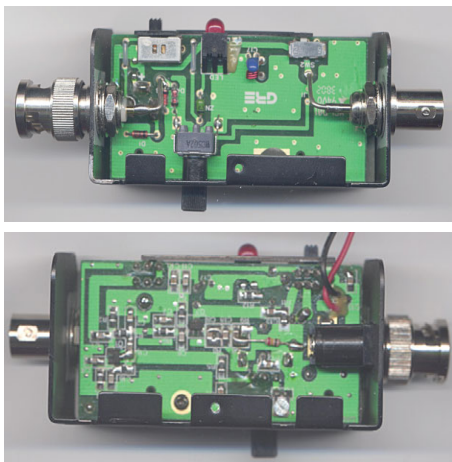
I could hear a small difference in signal strength on my Yaesu VR-500 by removing, then

SENSITIVITY OF PRO-92 vs.
PRO-92 WITH GRE SUPER AMPLIFIER
(12 dB SINAD FM)



GRE SUPER AMPLIFIER
LOSS WHEN BYPASSED





reinstalling the Super Amplifier. I measured the loss across a wide frequency range by using a spectrum analyzer and tracking generator.

As the graph shows, the loss is less than 2 dB up to 800 MHz and about 3 dB from 800 to 1200 MHz. A peak at approximately 877 MHz is probably due to a circuit resonance. GRE specifies the Super Amplifier up to 1000 MHz, but I am always curious about "pushing the envelope" and so I measured the loss up to 1500 MHz.

Removing the amplifier from the radio when not in use is a good idea to avoid the small signal loss. There are more compelling reasons to remove the amplifier when carried with a portable scanner in the field because the combination is unwieldy and additional stress placed on the scanner's antenna jack.

Closing Comments

The GRE Super Amplifier I tested is best suited for improving the performance of insensitive scanners and test equipment when used with an inefficient antenna. You may experience intermod if there are strong signals in your area.

◆ OptiVISOR Binocular Magnifier

It has become more difficult to repair and modify scanners as the circuitry becomes smaller and my close-in vision grows weaker.

Handheld magnifying glasses, a magnifying circular fluorescent lamp, and even an industrial stereoscopic microscope are helpful, but each has one drawback or another.

My dentist introduced me to the OptiVISOR, an optical glass binocular magnifier he uses to improve vision both in his dentistry practice and in his model railroading hobby.

The OptiVISOR consists of a pair of ground, polished glass lenses set in a "lense plate" and attached to a plastic hood and adjustable headband. A soft leather pad affixed to the headband cushions your forehead.

Unlike a single lens magnifying glass, the OptiVISOR's two lenses maintain your sense of depth perception because both eyes work together. Both your hands remain free because you wear the OptiVISOR instead of holding it like a magnifying glass. This makes it easy to solder and see what you're soldering at the same time!

The OptiVISOR can be worn with eyeglasses. The magnifying hood is hinged and can be lifted out of the way, like a welding mask, for

the times you want to see without using the lenses.

The OptiVISOR is available in 6 different powers. My dentist and I use the DA-5 model, which comes with a 2-1/2 power, 8-inch focal length lens plate. The lens plates and headband are also available separately, as are accessories like a battery operated lamp and a small loupe lens. The loupe rotates down in front of the lens plate to provide additional magnification for one eye.

I'm impressed with the OptiVISOR's quality and how it improves my vision. It is manufactured in Lenexa, Kansas, by Donegan Optical (<http://www.doneganoptical.com>) and sells for \$40 to \$50. I purchased an OptiVISOR from Transtronics (<http://www.xtronics.com>).



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Monitoring Planet Jupiter - Part 2

Last time we looked at the planet Jupiter, its satellites, and how they emit radio waves which we can monitor on Earth. Okay, so now that we have the basic Jovan physics under our belt and have used a program, Radio-Jupiter Pro, to help us predict these emissions, let's look at what types of radios/antenna systems we need for DXing our solar system.

Then we'll use a program that will let us "watch" and store our receiver's results. Finally, for the radio-challenged, we'll use the same program to access radios tuned to Jupiter at radio stations around the world. Ready for blastoff? Let's light this candle!

❖ Just a Local AM Station?

Well, not quite. Since Jupiter's emissions are broad-banded, the energy is spread over a spectrum swath. Therefore, there is no strong, narrow signal to key on. In fact, during daylight hours, the Earth's ionosphere is too electrically active to allow Jupiter's signals to penetrate it. Usually, Jupiter is best monitored after local sunset.

Although we can use the sideband mode to monitor the emissions, it can also be heard using the AM mode. Therefore, although you cannot use a \$10 China cheapie, the sensitivity/mode requirements are easily met by many medium quality shortwave radios. The use of a broadband signal amplifier at the antenna is not recommended, due to the problems of intermodulation and image interference that they usually introduce. If your receiver needs some help in the sensitivity department, use an amplified preselector. The tuned stage will help with interference from strong stations.

❖ Radio Requirements

Since we are going to monitor Jupiter's signal levels over hours, or days, long-term frequency stability, within a hundred or so kilohertz bandwidth, is required. Radios utilizing frequency-synthesized designs and many quality analog radios can easily attain the required level of stability.

As a result of Jupiter's wide-band emissions, narrow IF filtering is not needed, as long as adjacent station interference is not a problem. If your location is in a high population area, this increases the problem of interference from terrestrial noise sources. If this is the case, a receiver with a noise blanker will make Jupiter monitoring much easier.

Another helpful feature in a radio for Ju-

piter monitoring is the ability to disable the AGC (automatic gain control).

I used the ICOM R-71, R-7000 and an old Sony ICF2001 portable for my Jupiter monitor. Later we'll see that dedicated Jupiter monitoring stations use receivers such as the ICOM R-8500 and Kenwood TS-570. But these are at the very high end of the price range. In the 1970s I used an FRG-7 to monitor Jupiter with good results.

However, as the old radio adage says, "A radio is only as good as its antenna."

❖ Jupiter KISS Antenna

A Jupiter monitoring antenna can range from a large and expensive log periodic to a simple wire dipole. Let's stick to the Keep It Simple (*and Cheap*) dipoles. I used a long wire with a tuner and a multi-band dipole to monitor Jupiter.

Assuming we want to listen to Jupiter on 20.1 MHz we need to construct a dipole antenna with each arm measuring 11.5 feet. To get detailed construction instructions for a simple dipole and dual dipole antenna for 20.1 MHz go to http://radiojove.gsfc.nasa.gov/elab/rj_antennas.htm

Do not underestimate the importance of your antenna, especially when trying to monitor Jupiter! The above NASA website has lots of info on Jupiter monitoring as well as offering a receiver and antenna kit for \$125 plus shipping. However, I suggest that if you look around on-line and at hamfests you can find a multi-use receiver for only a little more money.

❖ What Does Jupiter Sound Like?

If you would like to hear a sample of what Jupiter sounds like, go to the following website: http://radiojove.gsfc.nasa.gov/control/obs_basics.htm#getting_started. There you can listen to L and S Bursts from the big planet.

❖ SkyPiping

Okay. Assume that we now have our station. And we are actually hearing what we think is Jupiter. Great! How do we display, record and store our results for analysis? The answer is a program called Radio-SkyPipe version 1.1.39. The standard edition is free at <http://www.radiosky.com/skypipeishere.html>. The Pro version, which I used, is also available on the site for \$39.99. After payment by credit card, a user name and password are sent to your email. The full Pro version features are unlocked

once this info is entered in your free version.

Computer requirements are modest: PC running Windows 95/98/NT/2000/Xp, 16 bit Sound and 32 MB of RAM recommended (but not required).

The program installs simply and quickly without any problems. The audio output of the receiver is connected to the computer's soundcard input. Putting all that we have learned together, I think we are now ready to monitor Jupiter.

Once the program is installed the user must indicate the hardware to be used for the receiver audio input to the computer. The audio can be either via the computer's soundcard or an external analog to digital converter. Construction details of suitable A/D converters are available in the On-line Help file accessed from the "Help" menu on the top command line. I used the soundcard input and chose the simplest (and therefore fastest) default digitizing parameters.

Jupiter's Signature

Figure 1 displays the main SkyPipe screen. The graph shows a period of time and the corresponding output of my receiver tuned to 20.1 MHz, one of Jupiter's favorite frequencies. The vertical (Y-axis) of the graph indicates relative strength of the signal at any given instant of time. The buttons on the left of the display allow the user to manipulate the gain and positioning of the trace. Most of the time I left this in the Auto-Scale Y-axis mode.

The X-axis along the bottom of the graph displays the time that the signal was received. The latest time is displayed on the right and updated every second or so. When the program is running, the graph is constantly scrolling to the left with the corresponding time of intercept shifting with it. The time is displayed in UTC (universal time coordinated). For most purposes consider UTC the same as GMT.

The graph is called a Strip Chart Display – a throwback to the days of ink and paper data graphing. A "strip" of paper moved under a pen at a constant velocity. Thus, the movement of the paper related directly to the time of the event. Figure 1 is an electronic strip chart of Jupiter's signal in a time period.

Instead of storing long pieces of paper strips, the SkyPipe stores the graphs to disk for later retrieval, analysis and sharing with other Jupiter listeners.

Pro Version Features

The Time Synchronizing feature of

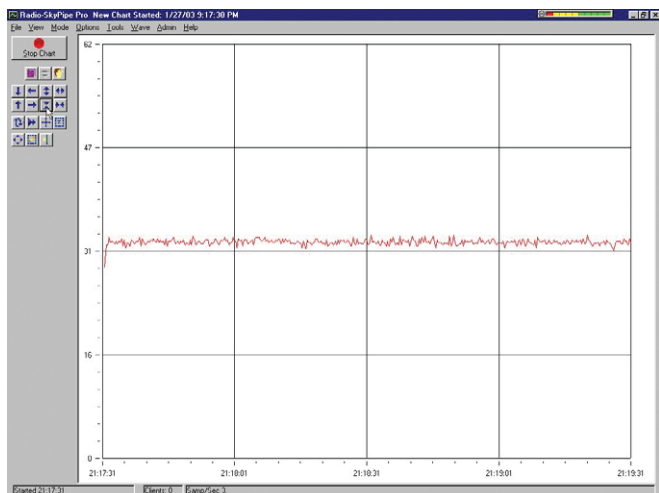


Figure 1 – SkyPipe displaying the output of my ICOM R-71 and a multi-band dipole tuned to 20.1 MHz in the Northeast USA

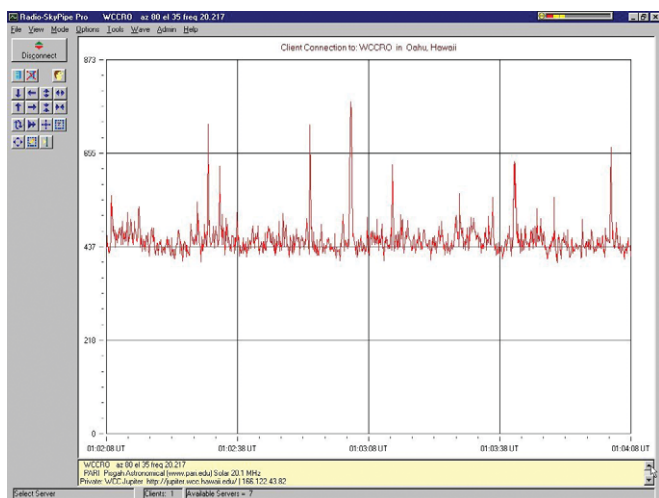


Figure 2 – SkyPipe displaying the output of WCCRO, in Hawaii, monitoring 20.217 MHz and sent over the Internet.

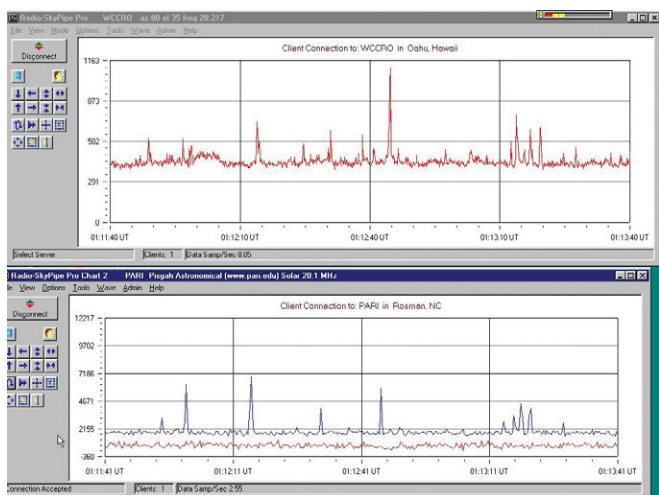


Figure 3 – Jupiter or Noise? Comparing possible Jupiter Signal from two receivers five thousand-miles apart. Top graph - Hawaii. Bottom graph - East Coast of USA. What do you think?

SkyPipe's Pro version allows the user to connect to number of internet sites with cesium time standards. The program synchronizes your time to their exacting time standard. This is performed from the "Tool" menu at the top of Figure 1.

receiver and log periodic antenna tuned to 20.217 MHz is displayed in Figure 2.

The available on-line stations (servers) is constantly changing and include anyone who has SkyPipe and wants to share their Jupiter signals.

While we are on the subject, the Pro version of Radio-SkyPipe has some very useful features including a wave recorder and player for storage and playback of monitored audio. The Multi-Channel feature allows simultaneous display of input from different sources; for example, two receivers tuned to different frequencies. The other Pro functions include Selective File Loading, Observer Log and Message Manager.

Jump'in Jupiter

What we are looking for in the graph are groups of pulses, not flat lines with tiny spikes. Since the Jupiter's emissions can be short-lived, we have to be diligent and persistent.

As bad luck would have it, Jupiter was relatively quiet during the evenings I was monitoring. Therefore, the graph in Figure 1 looks pretty uninteresting. Was it the time? Maybe. Was it the equipment? Maybe. Was it the operator? I don't think so!

For the Hardware Challenged (or Unlucky)

Radio-SkyPipe has another mode of operation that does not require any receiver or antenna. With an Internet connection you can use the extensive resources of radio observatories and individuals with radios and antenna configured for Jupiter listening.

This is achieved by clicking "Mode" on the top command line and then choosing "Client." A list of on-line radio telescopes is then displayed at the bottom of the screen. In Figure 2 we have already logged on to the Windward Community College Radio Observatory (WCCRO) in Oahu, Hawaii. The real-time output of their ICOM R-8500

Is It Really Jupiter?

Over the years as I attempted to monitor celestial radio sources, one part of my mind has always wondered, "Am I really just hearing/seeing local manmade noise?" Well, with SkyPipe this question was finally answered. The program allows the user to connect and display more than one receiving site in real time. Sooo, if we see the same signal pattern, at the same time, at two receiving sites, separated by thousands miles, it's not Memorex, baby ... it's real!

Figure 3 displays the receiver output of WCCRO in Hawaii (top) and PARI in North Carolina, USA (bottom). The PARI station is using a Kenwood TS850 receiver and a Yagi antenna tuned to 20.1 MHz.

Just a quick look at Figure 3 shows the amazing similarity of corresponding peaks between the two graphs. Check out the major peak to the right of 1:12:10. Then look at the peak in the middle of the graph to the right of 1:12:40 UTC. Also, look at the four closely generated peaks to the right of 1:13:11 UTC. Finally, just about all the peaks found in the bottom North Carolina graph is in the top Hawaii graph.

Keeping in mind that these graphs have been generated from receivers over five thousand miles apart! Yep, we really are looking at, and listening to, Jupiter. That's what I call DX!

Using this same technique we can verify our own receiver Jupiter intercepts by comparing them, in real-time, against the output from on-line stations.

SkyPipe and Pro are available at <http://www.radiosky.com/skypipeishere.html>. This site is a great resource for all kinds of info on amateur radio astronomy.

Back to Earth

Next time we'll come back to earth. In the future we'll take a new look at Palm Pilot programs for control of receivers such as the PCR-100, PCR-1000 and TenTec RX-320. This is an often-requested topic. If you have discovered a radio-related program you think is great, let me know so we can share it. Here's wishing you an early, warm and sunny spring.

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- **High Efficiency** – Most of the power fed into the antenna is radiated, so it's very efficient. Although some limited tests indicate its performance is not quite on par with half wave-length dipoles and verticals, many users report excellent results. The jury is still out on this one.
- **Superior signal-to-noise (S/N) Reception** – When used as a receiving antenna, the EH does not respond to locally generated noise which usually consists of only one field (either electric or magnetic, but not both). It only receives a wave when both electric and magnetic fields are in time phase with each other.
- **Inexpensive to build** – A low power (<100 watts) model can be built for less than \$20 in parts, so it is within reach of most individuals' budgets.

What's not great about the antenna:

- Based on the typical designs made public, it doesn't handle high power very well. This is due mainly to the currents and voltages that are present at the capacitors and cylindrical elements. However, prototypes have been built that function at 100 watts or less in the amateur radio application, and the inventor is in the process of testing a high power commercial unit in the AM broadcast band.
- Its features limit it to single band operation and based on its high-Q characteristics, it exhibits a fairly narrow bandwidth (although some would say it has good bandwidth for a device so small).
- Although it is easy to build, tuning and achieving good results are not as easy. It requires some tinkering and it is sensitive to changes in its environment (stray capacitance, surrounding metal objects, etc.). If you build one, you'll also need some antenna test gear to tune it.

Why It's Called an EH Antenna

It is called an EH antenna to emphasize the unique way it generates the electric and magnetic fields. The letters "E" and "H" represent the values of the electric and magnetic fields used in formulas that describe electromagnetic phenomena. Years ago, in the derivation of the formulas governing the characteristics of electromagnetic waves, the *electric field* was assigned the value of "E" and the *magnetic field* was assigned the value of "H." (The choice of the letter "H" for the magnetic field is a bit obtuse. I suppose the letter "M" as in "magnetic" was already in use somewhere else.) What's unique about the EH antenna, at least according to the inventor, is that the electric (E) and magnetic (H) fields are generated separately and in time phase *at the antenna* rather than at the far field as in conventional designs. This is the reason it was named an "EH" antenna.

How It Works

There have been numerous exchanges in antenna discussion forums by industry experts and many of these individuals are not in total agreement concerning the theoretical operation of the EH antenna. So I will not attempt to ex-

plain it either at this time. All I can offer is to restate, in my own words, some of the ideas presented about its operation and let you draw your own conclusions.

The EH antenna is deceptively simple from a physical viewpoint, but the theory of how it works is very complex. Also, many of those well versed in electromagnetic field theory are not in agreement as to what exactly is happening in producing the electric and magnetic fields radiated by this antenna. For example, the EH is really a "capacitance" antenna and, according to the inventor, operates on the principle of "displacement current" (which is defined by Maxwell's equations as current flowing through a capacitor).

As I stated earlier, the EH is somewhat controversial and this is one area where the controversy seems to be centered. When Maxwell first devised his famous equations, it was necessary for him to introduce the concept of displacement current to make the equations fit together. Although it is difficult to prove that displacement current exists in a physical sense, it is

generally accepted as mathematically correct and most assume it is there because the formulas produce correct results.

In the EH antenna (fig. 1) the electric and magnetic fields, according to the inventor, are generated separately and in phase at the antenna. The electric field is generated by the voltage which appears at the cylindrical capacitance elements, and the magnetic field is generated by the "displacement current" through the capacitance. Basic circuit theory tells us that current flowing through a capacitor leads the voltage by 90 degrees. So, if our antenna consisted of only the cylindrical capacitor, the electric and magnetic fields would be out of time phase with each other by 90 degrees and therefore, no radiation would occur.

Although it is not possible to delay the displacement current *within* the capacitor, it is possible, according to the inventor, to use a phase shift network to delay the current *before* it gets to the capacitor. That's exactly what he did to create the EH antenna. According to the inventor, in an EH antenna, a phase shift net-

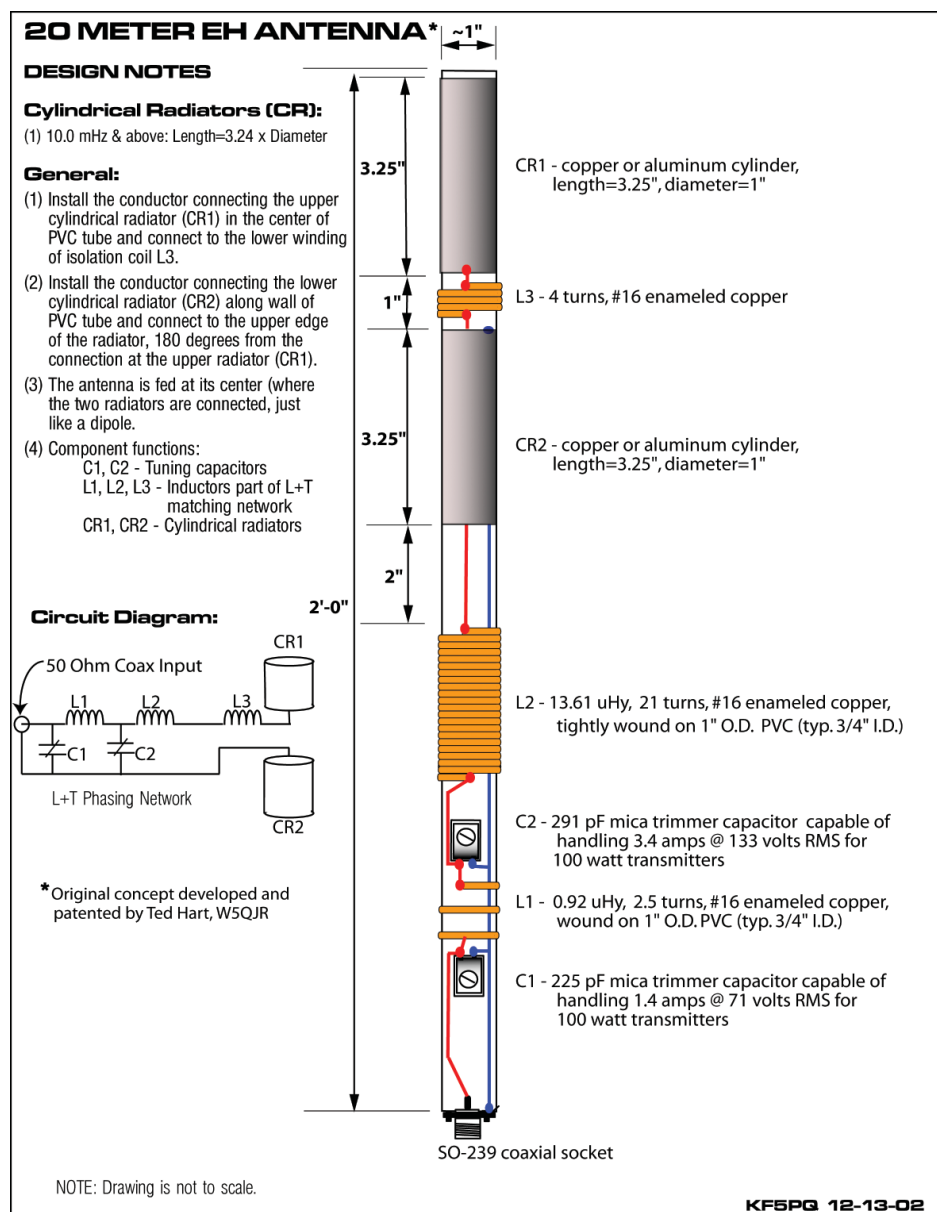


Fig. 2 – 20 Meter EH antenna based on Ted Hart's L+T Phase Shift/Matching Network.

work is added along with a matching network (to match the 30 ohms impedance of the antenna to a 50 ohm source). In so doing, the electric and magnetic fields are in phase and radiation occurs at the antenna (rather than at the far field as in the Hertz type antenna).

It's beyond the scope of this article to cover the mathematical theory behind the design and, as I stated earlier, many who are schooled in electromagnetic theory are not in total agreement that the radiation occurs in the manner described above. So, for additional information on the theory, check out the inventor's website (Reference 1) and the other sources listed.

At this point we may not be able to adequately explain the theory of operation of the EH antenna with respect to conventional antenna design criteria. However, it is still possible for those so inclined to build an EH antenna and verify for themselves empirically whether or not it works and whether the performance matches the claims. With about \$20 in parts and a Saturday afternoon, you could build a version of the EH antenna and conduct your own tests.

The difficult part is in tuning the antenna. You will need some basic test equipment (signal source, standing wave meter, field strength meter, capacitance and inductance meter, etc.) and some basic knowledge of electronic construction techniques. An ideal test unit is the MFJ Analyzer, because in addition to providing a signal source, it also measures SWR, frequency, impedance, capacitance, and inductance. If you like to experiment, you can have a lot of fun tinkering with this antenna.

What Others Are Saying About It

Information published to date about the EH (outside of the inventor's own documentation) generally falls into one of two categories. The first group are individuals who have actually built the EH and appear to have working models. The second group generally consists of individuals who are still analyzing it in an attempt to understand the theory behind its operation. The following is a sampling of websites from both camps with information concerning their experiences with the EH antenna:

Construction Sites –

As expected, most of the individuals currently building EH antennas are hams, located all over the world. Several amateurs in Europe have built various versions of the EH and share their experiences on personal web sites. One is Nino Pagliano, IZ7DJR in Italy and his web site is <http://www.qsl.net/iz7djr>. Nino has built a 40 meter model he calls the 'Zippiro' based on the L+L phase shift network. In Germany, Richard Westerman, DJ0IP has tested a 40 meter version with an excellent report at <http://www.eh-antenna.com> (look in the testimonials under the amateur section).

From France, check out Martial Roux's site at <http://f5ixu.waika9.com/>. This site is in French, but you can view it in any language

through Google's search engine language tools. A photo of one of Martial Roux's EH antennas is shown in Fig. 3. The most detailed site with step-by-step instructions and photos is one by Terje Isberg at <http://www.omnirep.ch/eh.html>. In Sweden, there is even an EH antenna users group. Start with Conny Winrot, SM5DCO at <http://www.qsl.net/sm5dco> or Sixten Enstrom, SM5DAJ at <http://hem.bredband.net/sixens/index.htm>.

Analysis Sites –

Several papers have been written by individuals well versed in antenna theory and electromagnetics. For some interesting analysis of the EH, check out the report, *The EH Analyzed* by Joel C. Hungerford, KB1EGI, at <http://www.antennex.com/hws/ws1201/theeh.html>. Joel used a software program called Pspice to analyze the EH equivalent circuit.

Recently, Lloyd Butler, VK5BR developed a different analysis of the antenna concepts. His web site is located at <http://users.tpg.com.au/users/lbbutler>. It is interesting to note that he theorizes that the magnetic field may not be produced by the displacement current through the antenna capacitor. His conclusion is that the magnetic field may be produced by current flowing through the radiation resistance that is in parallel with the antenna capacitance. If that is the case, all that is needed is inductance to cancel out the capacitive reactance of the antenna. This explanation differs from that of the developer.

So, as you can see, there is nothing conclusive on how this antenna operates. Eventually, the theory will catch up with the empirical data and only then will we fully understand how this new design is able to transmit or receive a signal.



Fig. 3 – Photo of typical EH antenna constructed by Martial Roux, F5IXU (used with permission).

Building Your Own EH Antenna

There are several existing sources providing details on how to build your own EH antenna, so I will not repeat that information here. To start with, you may want to review the information provided by the developer, Ted Hart at the EH Antenna website. The URL is <http://www.eh-antenna.com>. Once there, check out the amateur section and specifically the article entitled: *20 meter Backpacker*.

There are two versions of the phase shift network – the L+L original design and the newer L+T network. The L+T network is recommended for initial construction projects as it is easier to understand and tune up. The 20 meter Backpacker is based on the simpler L+T network and a drawing of the complete antenna is shown in fig. 2.

Conclusions

The EH is definitely a unique design, it comes in a small package, and there will always be applications begging for a compact, highly efficient transmitting and receiving antenna design. For example, individuals with property restrictions or apartment dwellers who can't install full size antennas might be happy with the EH as a stealth antenna. Applications requiring a small, portable antenna for HF operation while traveling are also candidates.

In addition, its compact size (approximately 2 percent of conventional half-wave designs) makes it an ideal candidate for commercial shortwave broadcasters, public safety installations, and even the military.

However, the lack of reliable and repeatable test data at this time prevents anyone from determining conclusively if the EH measures up to its claims. For now, the jury is still out and we will have to wait until more quantifiable data is available before we know the future of the EH antenna.

References For Further Reading

- (1) <http://www.eh-antenna.com> – website of the inventor, Ted Hart, W5QJR. Includes articles explaining how the EH antenna works, technical files and helpful hints on building EH antennas.
- (2) <http://www.eheuroantenna.com> – website of European licensee Stefano Galastri, IK5IIR. Designs, manufactures and sells commercial versions of the EH antenna. This site has an article describing how to build a 40 meter version.
- (3) <http://www.qsl.net/w0kph> – website of Jack Arnold, W0KPH. Several EH antenna designs plus calculators for coil and phasing network design for the EH antenna.
- (4) <http://www.eHam.net/articles/3586> – Article by KE0VH discussing the virtues of the EH antenna with follow up discussions.
- (5) <http://www.antennex.com/hws/ws1201/theeh.html> – report by Joel Hungerford, KB1EGI entitled *The EH Analyzed*. Using a software program (Pspice), Joel analyzed the characteristics of the EH and reported his findings.
- (6) <http://groups.yahoo.com/group/eh-antenna> – discussion group moderated by Ted Hart (inventor of EH antenna). Requires joining to see messages.
- (7) <http://www.qsl.net/vk5br/EHCalc.pdf> – An alternative view of the theory of how this antenna operates.

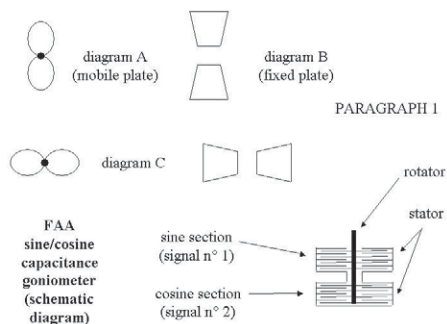
Rotary Antenna System Solutions

By Michel Berlie-Sarrazin

As a result of my “highly directional double loop antenna” article (see June 2002 *MT* issue), I received a letter from Mr. Ralph C. Craig (AJ8R) suggesting some other ways to achieve loop rotation while still maintaining connection to the signal wave “captured” by the antenna.

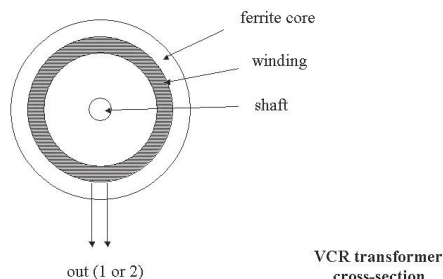
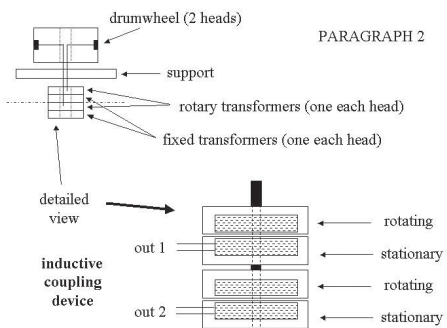
These ideas are so clever and interesting I decided to share them with other *MT* readers. Especially since they are also useful for other rotating antenna systems besides loops.

Here is the text from Ralph Craig.



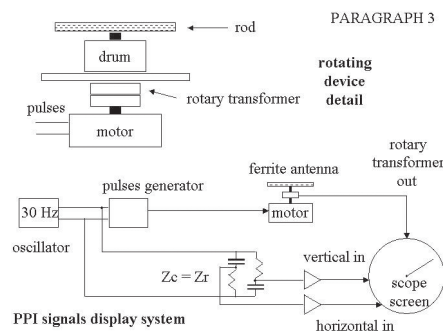
1. “... In use by the FAA (Federal Aviation Administration) is a system for conducting a rotating signal to stationary antennas. In effect it is a sine/cosine capacitance goniometer. The plates on the rotator are cut for a sine output (see diagram A). The stator plates are cut to fit available space (see diagram B). To get cosine outputs, the cosine plates (the same as the sine plates) are mounted on the rotor shaft 90 degrees (see diagram C).

“By keeping the loops stationary and revolving the goniometer (rotator axis) and feeding signals direct to a CRT, you would get a P.P.I. (plan position indicator) presentation of the signal...”



PARAGRAPH 2

2. “...A second (and better) way of getting the revolving loop signals to a stationary receiver is cheaply and readily available in inoperative VCRs. The video recording drumwheel has two video heads that record/play back data on the tapes. The information is recorded and taken off the tapes using low frequency R.F. signals. The information is transmitted to the external circuits using rotating transformers (in very old sets through slip rings). By removing the small video heads, mounting the loops on the drumwheel and connecting them to the wires connected to the rotary transformers, you get a noiseless, low loss coupling device. See diagram...”



3. “... A third means of getting the signals from and to the loops while rotating them at the same time is also available from the VCR. The video drumwheel is rotated by a motor whose speed is very accurately controlled. By replacing the large loops with ferrite rods the ‘loops’ can be readily mounted on the drumwheel and the ‘loops’ connected to the rotary transformers.

“The motors on various VCRs are of several types: stepper, synchronous, governor con-

trolled, or proprietary, but they all get their timing from timing pulses from counting down the reference oscillator. The speed is accurately controlled by 30 cps signals. By supplying these pulses from an external oscillator and running the oscillator signals through a 90 degrees sine/cosine phase shift network to the horizontal and vertical inputs of an oscilloscope, you would get a synchronized circular sweep. The loop signals could be processed in several ways to give a P.P.I. display on the scope. See diagram...”

Thank you very much, Mr. Craig, for sharing with all of us this technical data.

Supplementary Suggestions

As a supplement to these ideas, here are a few new suggestions of my own for single or double loop antennas:

4. Why not replace the oscilloscope (cited in the third paragraph) with an emulating software and an electronic box? This equipment (oscilloscope emulator) is widely available and its cost is not excessive. Furthermore, portable or desktop computers being more widespread amongst SWL and DXers than oscilloscopes, we have an economical (and technically simple) means to get P.P.I. on screen (or stored on the hard drive).

5. If you practice computer programming or know somebody involved in this field, it should be possible to develop a specific software to convert analog values (intensity of incoming signals and loop angle of rotation, respectively) into digital values with the help of an A/D converter. Then these data could be used to simulate a P.P.I. scope on the computer screen.

Choosing a 360° digital optical encoder to measure the loop’s angle of rotation, it is directly processed by an available digital port.

6. In a double loop antenna, if necessary, the process of subtracting (between the control loop signal and receiving loop signal) in order to get the resultant signal (according to directivity diagram of the double loop system), is also workable by the computer before the P.P.I. is displayed.

A last possibility: the subtracting process could be performed through a standard sound card (L & R line in) connected to the B.F. output of two receivers (AGC off) which are connected to the double loop antenna (one channel dedicated to control loop, the other to receiving

MT REVIEW

Talon Magnetic-Antenna Mast Adaptor

By Bob Grove W8JHD

This clever new antenna-mounting accessory is one of the handiest we've seen for experimenters (like me!) who constantly switch antennas around on masts and towers. Its secret lies in a patented (U.S. Patent 6,348,899 B1) cross-arm brace ("boom") with secure steel pads to hold magnetic mounts.

Available in a choice of sizes, the two units we sampled for review are 70" and 49" long, respectively, and are shown in the photo. The rugged braces are moderately webbed to reduce wind loading without sacrificing strength.

The longer boom is fabricated from 304 non-magnetic stainless steel, fitted with 17-4 stainless magnetic pads to accommodate magnetic-base antennas. The shorter boom is made from 1018 zinc-galvanized carbon steel; since it's magnetic, end pads are unnecessary.

The cross-arms are provided pre-drilled for U-bolts; one pair required per brace. The U-bolts hold the impressive booms either on a pipe mast or vertical corner pipe of a tower.



Applications

Up to four magnetic-base antennas may be mounted on either of these braces. For example, an avid experimenter might choose to mount a CB whip, VHF/UHF ham whip antenna, external cellular phone antenna, and a scanner antenna all on one cross-arm.

Choice of boom length is dependent upon wavelength separation required for any two antennas co-located at the same height. Antenna elements in the same plane must be mounted no closer than 1/4 wavelength at the lowest frequency of intended use to prevent pattern distortion. This includes the intervening metal mast or tower as an "element."

Additional booms may be mounted above or below one another, provided the antennas from each don't overlap. Configurations can include multi-frequency arrays with separate coax feed lines, gain arrays using common feed lines, and even an Adcock RDF array. In the case of a directional pattern, the boom may be mounted on a rotator.

The fact that the two underside antennas are mounted "upside down" has no bearing on performance, unless the radiation pattern is not at right angles to the whip. In that



case, the pattern will rise or fall from the horizon in the opposite manner from when the whip was pointed upward.

Our test

With our endless collection of magnetic-base whips, I was eager to test the Talon cross-arm braces. Mounting them was simplicity itself since no assembly is required; simply unpack the brace and mount it to your vertical support with U-bolts. The magnetic bases of the whips locked securely into place on the steel pads, and the cables were run over to the mast and down.

It's a good idea to tape the cables to the mast at least at one point to keep them from flapping in the wind. Since cables on mobile mag-mounts are only 12-16 feet in length, it will be necessary to extend the cables with a barrel connector and additional cable with mating connectors. Weatherproof the coupling joint with waterproof tape or coax sealant covered with PVC electrical tape.

Other uses

Special needs for meteorological sensors, maritime shipboard environments, solar arrays, wind-powered generators, video surveillance platforms, non-magnetic military requirements, and other applications can be custom-ordered with titanium, carbon fiber, Plexiglass, or other materials.

For further information, pricing and availability, contact the manufacturer: Talon Creative, Inc., PO Box 1111, Chino Valley, AZ 86323; phone/fax (928) 777-8839.

On the Bench continued

loop).

◆ Technical Considerations

If we take video recording requirements into consideration, the usable frequency range of VCR rotating transformers could be from 60 Hz to 3000 kHz. In other words, from ELF to the beginning of HF band.

I can foresee a potential problem in case the signal level picked up by loop (or ferrite rod) antenna is too weak (that is in the microvolt range): an excessive loss, between primary (rotating) and secondary (fixed) transformers coils, could result in an insufficient and unusable sig-

nal level compared to the sensitivity of the input (HF amplifier) stage of our receiver. The problem should be sorted out by adding a small HF preamplifier between the antenna system output and rotating transformer input in order to boost signals into the millivolt range.

I have to state that all the ideas and suggestions made in this article are provided as working hypothesis, since I have not yet tried to put them into practice. I think they are good starting points; however, as always, only a workbench test will be the touchstone of their full validity.

This is your equipment page. Monitoring Times pays for projects, reviews, radio theory and hardware topics. Contact Rachel Baughn, 7540 Hwy 64 West, Brasstown, NC 28902; editor@monitoringtimes.com.

C Crane Lights the Way

C. Crane said: "Let there be light" and it was *excellent!*

All right, call me a fuddy-duddy, but I'm the kind of guy who believes that it is prudent to know where the emergency stuff is *before* the emergency happens (what a concept!).

So that means that around the Elliott household I know exactly where there is a battery-powered radio, extra batteries and a small kit of goodies that might come in handy when the power goes out or other Bad Things happen. That also means there are flashlights scattered in strategic locations throughout the house: one by the side of the bed, another on my desk, and yet another in the emergency kit. Further, there is a flashlight in the toolkit in the car and additional "electric torches" (as the Brits would have it) that go in our camping gear.

Over the years, I have purchased a lot of flashlights: big ones, little ones, high tech ones. I have spent beaucoup bucks on them, and that leads me to a serious gripe: *all* of them have let me down. Usually it is the switches that fail, becoming intermittent and threatening to plunge me into darkness just when I need it most. I've even had high-dollar, so-called professional grade flashlights give up the ghost. And I've found that some of the highly-touted machined aluminum models have bulbs for which it can be hard to find replacements.

As a result, I've adopted the attitude that flashlights are a consumable, disposable item. Buy a bunch of the cheap ones and toss 'em out when they die; that's my recommendation. That is, until recently.

Last summer I was chatting with the folks at C. Crane when I mentioned in passing my disappointment with run-of-the-mill flashlights, even the expensive ones. "Why don't you give our LED flashlights a try?" they suggested.

So I did, and for the past several months I have been using a CC Trek Light (with two white LEDs and three AA batteries), a CC Expedition (with seven LEDs and three C cells) and a Mini Trek Light (with two LEDs powered by three AAA batteries). Each of these remarkable flashlights is waterproof to well over 100 ft., shockproof, and has a tough plastic body and a LEXAN lens. Further, each has a darn-near bulletproof twist on/ twist off switch that is activated by rotating the lens.

♦ Jock sees the light

What really sets these flashlights apart is that they use Light Emitting Diodes (that's what LED stands for) to produce light. Unlike incandescent bulbs, which get hot, burn out, often break and normally last only 20 hours, the LEDs stay cool, produce a clean white light, are unbreakable and typically last for *thousands* of hours. (That's *not* a typo.) Further, the LEDs just sip power from the batteries – you can expect to get hundreds of hours of useful light on a single set of batteries with the CC Trek Light and the Expedition. Even the diminutive Mini Trek Light will deliver well over 100 hours of useful light on one set of batteries.

And tough? I've dropped, kicked, rolled, bounced, and hit these flashlights and they haven't cried, whimpered or gone out . . . they just keep shining. After several months, I've yet to change the batteries in any of them.

In my not-so-humble opinion, these are – hands-down, no-quarter-asked-and-none-given – the best dang flashlights on the planet. That is, until the phone rang a couple of days ago.

♦ Less is more

It was someone calling from C. Crane Company to say that they were changing several of their LED flashlights, and a package was on the way to me. Now, here's the really good part: in an age when so many corporations appear to "dis-improve" their products to save costs and improve the bottom line, the technical boffins at C Crane have actually made their LED flashlights *better* with the addition of something they call the "Advanced Control Circuit."

In a bit of technical wizardry that seems completely counterintuitive to me, the Advanced



Hands down, the best flashlights on the planet.

Control Circuit squeezes more light from each LED while – get this! – *reducing power consumption* and extending the life of the LEDs. (To me, this is like souping up your car to find out it gets better gas mileage.)

As a result, the new, improved CC Trek Light produces nearly 50% more light than its predecessor, delivers full brightness for 50 hours, and useful light for hundreds of additional hours. The new 6-LED Expedition 600 (powered by three C cells), with Advanced Control Circuit, equals the brightness of the older 7-LED model and will last for hundreds of hours. And the new 12-LED Expedition (with three C cells) outshines the original 19-LED Expedition and will last for hundreds of hours. The two Expedition models each have a fresnel lens that focuses the light for greater range.

These C Crane flashlights are expensive but worth every penny. The 2-LED Trek Light is \$29.95; the Expedition 600, \$64.95; and the Expedition 1200 is \$99.95. But when you consider they are so durable they will probably last long enough to be included in your will, and they will save you substantial dollars on batteries over the years, they get my highest personal recommendation. Trust "Uncle" Jock on this: you need one of these lights in your emergency kit, 'cause you'll never have to wonder if it will work when you need it. For more information, contact C. Crane Company, 1-800-522-8863 or visit <http://www.ccrane.com>.



WXSAT to Imaging Program

Winter weather in the northern hemisphere and summer weather “down south” has resulted in some astonishing images being received from the various weather satellites (WXSATs). Fires in Australia and ice-breaker ships in the Gulf of Bothnia have all left their mark for those with the right equipment (and the right location!) to collect. Many of the images have been posted on the Internet.

◆ Operational WXSATs

Meteor 3-5 surprised us during January by being heard during its southern hemisphere passes across sunlit earth. Meteor 3-5 southbound morning passes transmitting visible-light APT on 137.3 MHz were monitored until January 18, then off until January 25, on for a few more days, and then finally off from January 29. Thanks to Mike Kenny in Australia for this information. Meanwhile, NOAA-14 HRPT (the high resolution images transmitted in the 1700 MHz band) became once more degraded by loss of synchronization. Hopefully this might only be a short-term effect.

◆ Software from New Zealand

There are two authors who have regularly updated their software for the benefit of WXSAT users. **David Taylor** of Britain wrote his suite of SatSignal and associated software, and **Craig Anderson** of **Abstract Technologies New Zealand Limited** has also kept users fed with new, ever more capable versions of the products. I am sure that WXSAT hobbyists would like to be kept up-to-date with software matters, so I plan to provide regular notes on the new versions. This month I have a brief introductory look at Craig's *WXTIMG* (WXSAT to imaging) pro-

gram, currently in version 2.3.20 (dated 15 January 2003).

Before discussing the program, I should clarify what equipment is needed to use it. The software requires a suitable WXSAT receiver and antenna. Other possibilities include the Remote Imaging Group's RX2 receiver that is available to club members. Craig suggested to me that I could also try a standard communications receiver, as well as my usual Timestep equipment. I decided that I would try that after mastering the normal method!

For best results you should have a 137 MHz band, crossed-dipole or comparable antenna (many use the quadrifilar helix design) fed by low-loss cable into your receiver. The output from this should include the extracted 2.4 kHz sub-carrier that contains the modulated signal data.

◆ WXTIMG

The program performs the dual job of both recording the audio output from a WXSAT receiver, and processing it accordingly to various options.

Craig comments: “*WXTIMG* is fully automated APT and WEFAX weather satellite recording, decoding, editing, and viewing software for all versions of Windows, Linux, and MacOS. Supports map overlays, advanced colour enhancements, 3-D images, animations, multi-pass images, projection transformation (for example Mercator), text overlays, temperature display, and control for many weather satellite receivers, communications receivers, and scanners.”

Installation

<http://www.weather.net.nz/wxtoimg/>

After downloading the program from the web site, it can be installed in your preferred directory. The program includes a *help* file, though you can achieve results before reading this thoroughly.

Download the latest Kepler elements and place in the *WXTIMG* directory. This enables the program to identify the satellites. Ensure your system clock is accurate: Recently I started using an automated update from the US Naval Observatory via the Internet.

Set the sound level correctly, because the quality of the image depends on this setting. Connect a suitable cable from your receiver to the line-input of your computer's sound card. The Windows' *sound recorder* (accessories, entertainment,

sound recorder) can be used to check the signal level – preferably using a live satellite signal. In the absence of a satellite, just use noise from the unsquelched receiver to validate the recording. You may need to run the *mixer control* option (*File menu*). Ensure that *line input* is selected and then adjust the volume control to achieve a moderate level. Too high a signal results in bleached whites with little detail. During recording, a numerical display shows the level: The instructions recommend adjusting this to read between 50 and 75 when the WXSAT is overhead. The display is color coded for convenience.

After the first pass, you should have a wav (sound) file; this can be processed immediately – if you set the options accordingly. There are many processing and program options. Menu options include file, direction, satellite, enhancements, options, projection, image and help. Some options are only available in the registered version. I am currently using the standard (freeware) version.

Features include automatic Kepler updates, multi-spectral analysis (MSA) to produce realistic color, extensive image processing to achieve good quality images, map overlays for Meteor (as well as NOAA) WXSATs, and im-

proved decoding from narrow bandwidth receivers. Unattended recording works well; you can set the program to record whenever the squelch is opened, or for selected passes. The software can operate a compatible WXSAT receiver. The mode “recording only” can be enabled to avoid automatic processing, thereby possibly preventing a second recording just after reception is completed. Craig sent me figure 2 – a multi-spectral (MSA) image of New Zealand processed by *WXTIMG*.

◆ End Notes

Finally, I must express my sadness at the destruction of Shuttle *Columbia* with the loss of its astronauts during the days while writing this article. As a long-time believer in the space program, I was stunned by this loss.

APT (and GOES) Frequencies

NOAA-12 and -15 transmit APT on 137.50 MHz

NOAA-17 transmits APT on 137.62 MHz

Meteor 3-5 normally transmits APT on 137.30 MHz when in sunlight

GOES-8 and GOES-10 use 1691 MHz for WEFAX

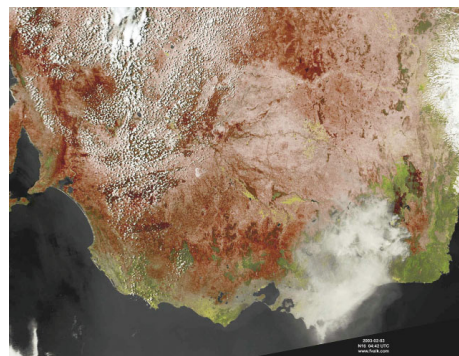


Fig 1: NOAA-16 captures Australian bush fires - courtesy Ferdinand Valk using SAA data. Ferdinand collects NOAA data from the NOAA Satellite Active Archive and processed it to produce this colorful image.

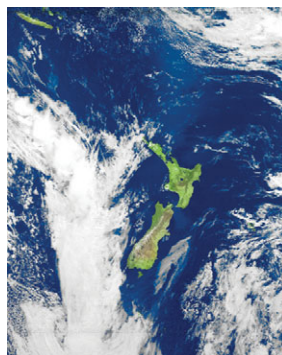


Fig 2: NOAA images of New Zealand from Craig Anderson

What's NEW

Tell them you saw it in Monitoring Times

ICOM IC-R5

Icom's newest compact wideband handheld receiver is the IC-R5. Despite its size, the receiver features crisp, clear audio and a super wide tuning range. The R5 is the first handheld with a weather alert function to keep you informed of weather emergencies, and its weather resistant case makes it ideal for outdoor use.

Wide band receive includes 495 kHz - 1309.995 MHz*, AM/FM/WFM. Listen to AM/FM broadcast radio stations, police, fire, military, aircraft, various amateur bands, and more.

There are a variety of ways to store and access frequencies. It comes with preprogrammed TV and shortwave memories, can accommodate 1250 memory channels with alphanumeric naming (1000 memory, 25 scan edge pairs, 200 auto-write scan memory channels). The R5 is PC programmable using optional software and cloning cable.

A large, easy-to-read LCD display with the visual information you need - like operating status, signal strength, battery indicator, and alphanumeric naming.

The Icom IC-R5 is available from MT advertisers, including Grove Enterprises (\$189.95 at press time; call 1-800-438-8155 or email order@grove-ent.com).



Switch On! Electronic Building Blocks

If you have a child or grandchild eight years or older, here's a great activity to give you both some fun and education. Switch On! is a set of electronic modules or building blocks from Scientifics that can be used to construct over 40 different circuit set-ups.

Each block is labeled with its



electronic part name, code number and symbol, allowing the user to easily follow the provided color-coded schematics. It can help young electrical engineers understand the concepts behind circuitry and schematic reading. Blocks quickly and securely snap together.

Projects include a magnet-controlled lamp, a conductor tester, an adjustable light, an electronics show, even a karaoke machine—all required parts and instructions included. The projects are powered by four "AA" batteries, not included.

Switch On! Electronic Building Blocks are \$59.95 from Scientifics, 60 Pearce Avenue, Tonawanda, NY 14150-6711; 1-800-728-6999; <http://www.scientificsonline.com>

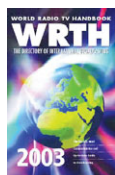
World Radio TV Handbook

David Bobbett, Editor in Chief

As an active hobbyist, the *World Radio TV Handbook* (WRTH) has for many years been an important reference in my DXing library. For most like-minded enthusiasts, this comprehensive reference book serves as a guide and directory of international broadcasting information.

As with past editions, the 2003 WRTH includes receiver reviews, frequencies, addresses and background information on broadcasting. The future of shortwave is an interesting development to ponder in this year's digital radio feature. *The Politics of Broadcasting* is equally informative as you consider the on-going debate on the future of HF broadcasting.

Reference sections on propagation, broadcasting organizations and listener clubs are an asset to the



newcomer, while the useful web sites and mailing lists will assist your hobby.

One of the most obvious improvements is the amount of new and revised information, as a direct result of an increase in international contributing staff. Compared to earlier editions, *WRTH 2003* appears to be more valid and more complete.

As with any hobby reference, there will be occasional inconsistencies. Transmitter sites should be confirmed. These sites are especially important to those country chasers that collect verification cards. The editors should also consider listing the clandestine stations as a single section, instead of dividing them into international and domestic stations. Why not consider the same for broadcasters, instead of separate national radio and international radio?

The TV section could use an update of satellite TV broadcasters, while domestic TV DXers would benefit from a more complete listing, instead of listing only those networks providing programming to local stations nationwide.

As a reference for the hobbyist, *WRTH* is still an excellent guide. DXers who specialize in tropical band listening, medium wave and TV DXing, should consider other publications, club newsletters, or on-line radio mailing-list for the latest information.

The editorial staff at *WRTH* has clearly improved this important reference book from past editions, and I would recommend the 2003 edition as an asset for the casual listener or seasoned DXer.

WRTH 2003 (BOK-03-03) is available for \$24.95 at Grove Enterprises at 1-800-438-8155, or order on-line at <http://www.grove-ent.com>.

- Gayle Van Horn/MT
Frequency Manager

"Ask Bob" Anthology

For more than two decades, Bob Grove's popular "Ask Bob" monthly column has been a favorite among *Monitoring Times* readers. Now you can enjoy reading hundreds of the most informative questions and answers submitted by readers over the years, specially chosen for

this edition based upon timeliness, general appeal and importance.

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As a special bonus to owners, the *Ask Bob* CD contains five videos featuring the "answer man" himself. Bob Grove explains the basics of Selectivity, Trunking, Repeaters, Dynamic Range and AC Adapters. System requirements to run the videos are: Pentium 400 or higher processor, 8mb video card, CD-ROM or DVD-ROM drive.

The *Ask Bob Anthology* on CD is \$19.95 plus \$3.50 shipping from Grove Enterprises, 1-800-438-8155, or order on-line at <http://www.grove-ent.com>.

SPRAT CD-ROM Library An Electronic Projects Cornucopia

SPRAT (Small Powered Radio Amateur Transmissions) is a world renowned English QRP (low power) club. To learn more about them see: <http://www.gqrp.com>.

A Quick Look at the SPRAT CD-ROM

If you are looking for antenna, SWL and radioamateur electronic projects, the SPRAT CD-ROM is just what you need. All the previous printed issues (from number 1 to 109!) of their quarterly publications are included in the newest (second) edition of this CD-ROM.

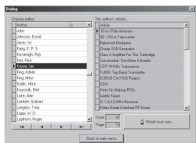
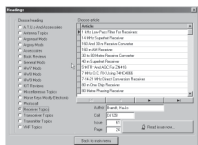
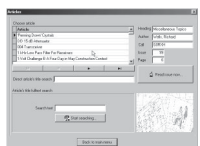
To access and browse through it you need Acrobat Reader software (PDF format files reader) version 4.0, or more recent (free from <http://www.adobe.com>). You can search by authors' calls, authors' names, articles, headings, issues. If this is not sufficient, direct article title search and article fulltext search (key words) are possible. Naturally, you are allowed to print all the items you are interested in (one page, several pages, all the SPRAT issue selected),

What's NEW

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and copy pdf files from the CD-ROM to your hard drive (each SPRAT issue is a separate pdf file).

Of course, there are many plans for QRP transmitters or transceivers, but receivers are also included, including direct conversion projects. Extensive use is made of integrated circuits to simplify construction, but if you prefer valve (tube) transceivers and receivers, they are not forgotten. Other projects include HF converters, crystal oscillators, VFOs, electronic keyers, attenuators, antenna tuners, and more.



As regards antennas, dozens are available: many loops of all sorts (HF bands), and numerous wire ones (several of them being tailored to limited space or of the invisible kind).

And that is not all! There are all sorts of electronic measuring devices (grid dips, HF wattmeters, field meters, crystal testers, inductance/capacitance meters, frequency counters, SWR analyzer...), and accessories to enhance the performance and/or range of equipment you have already (jaw type current probe, RF probes, etc.). Among topics such as filters and B.F. accessories, are some rather unusual ones such as solid state speech recorder, CW filter, audio compressors, noise limiter, etc..

Technical articles dealing with CCW (coherent CW) and other exotic communication modes are at your disposal. The readers' letters section is full of practical advice and reports of experiments.

Best of all, most of the assemblies are possible without complicated or expensive laboratory devices (like oscilloscopes or spectrum analyzers), but just common tools and a volt/ampere/ohm-meter.

How To Get It:

This SPRAT CD-ROM version 2 (PC and Windows 9x or upwards required) is available worldwide. US/Canadian hobbyists can order it from Bill Kelsey, N8ET, Kanga US, 3521 Spring Lake Drive, Findlay, OH 45840 (DX members US\$ 15/non-members \$17 incl s/h, 2nd class/surface mail). Members in Europe order from Funkamateer, PO box 73, 10122 Berlin, Germany (<http://www.funkamateer.de>). UK hobbyists order from Graham Firth, G3MFJ, 13 Wynmore Drive, Bramhope, Leeds, LS16 9DQ, U.K (UK members: £ 10 / non-members : £ 15). North American members can order from Graham Firth, but pay Bill Kelsey.

— Michel Berlie-Sarrazin

Guidelines for Local Christian Radio

by Kenneth D. MacHarg

Proclaiming the Gospel; Guidelines for Local Christian Radio is a new guidebook designed to help Christian radio programmers outside of North America develop compelling, quality broadcasts.

Published by the Miami-based Latin America Mission, the new volume was written especially to help those Christian individuals and churches in developing countries that have obtained stations or programming time but aren't sure what to do with them.

MacHarg developed the idea for the book after speaking at a Christian writer's conference in Temuco, Chile, several years ago. "I found many Latin Americans who were getting into radio or wanted to, but who had absolutely no resources to help them," he said. "In a seminary library in Temuco I was not able to find one book or pamphlet that gave guidance on how to develop quality Christian programming."

Proclaiming the Gospel begins with a biblical perspective on communication, then moves to discus-

sions about programming style, developing a smooth-flowing, coherent program format, the selection of speakers and music, announcing and studio techniques, promotion and publicity, the funding of Christian radio programming and additional resources.

"In the last ten or more years, God has raised up a new era of broadcasting with low-powered Christian radio," said Allan McGuirl, president of Hamilton, Ontario-based Galcom, a ministry that provides fledgling Christian operations around the world with low-cost transmitters and studios and solar-powered receivers. "This has made possible the placing of small radio stations in many countries around the world."

McGuirl asked MacHarg to write the book a year ago. Galcom is helping to provide a Spanish translation of the book that will be available in mid-2003. The English edition will be available for \$6 plus shipping from LAM in early March, 2003.

MacHarg brings long media experience to the writing of the book. He served as a missionary broadcaster with HCJB in Ecuador and has also worked at several radio stations in the Louisville, Kentucky, area. He has taught communications at several colleges and at the Miami International Seminary in Miami, Florida. He is the author of four other books and currently is a missionary journalist and Communication's Coordinator for the Latin America Mission.

While the book is primarily designed for Christians outside of North America, its insights into programming and Christian radio operations will be most valuable to anyone who wants to get into the field of Christian broadcasting anywhere.

The book will be published by Editorial Buena Semilla in Bogota, Colombia, and will be available for \$6.00 plus \$2.00 shipping in the U.S. and \$3.00 shipping elsewhere in the world. It may be ordered from Latin America Mission, Box 52-7900, Miami, FL 33152 USA.

Astronomy Demystified

by Stan Gibilisco

Most of us who are curious enough about nature to wonder

what's inside our radios are also interested in the cosmos as well. I know I am, and so is author Stan Gibilisco, whose expert books and articles on radio have been published for years.

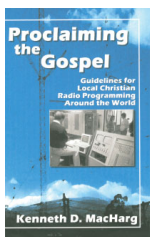
Astronomy Demystified is subtitled "A Self-Teaching Guide," and it does a good job of that. Gibilisco's new treatise can be used as a casual reference for the occasionally curious, or a detailed curriculum in astronomy for the more intellectually adventurous.

Nearly 500 pages make this more than a pamphlet; its husky, well-illustrated contents take us on a tour of the universe, beginning with an explanation of how to map the nighttime sky, continuing through an in-depth probe of our own solar system, on into the realm of the galaxies.

Additional topics include relativity, telescope theory and practice, the search for extraterrestrial life, quasars, traveling through and living in space and, of course, radio astronomy. All subjects are illustrated for a learning aid, and each major chapter ends with a self test to see if you were awake. Don't worry — you won't be graded, and it is multiple choice!

Astronomy Demystified is an ambitious undertaking, explaining difficult concepts in easy-to-understand terms for the layman, and Gibilisco does it well; we'd expect no less from him.

\$19.95 from McGraw-Hill and their dealer network. Visit their web site at <http://www.books.mcgraw-hill.com>.



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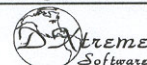
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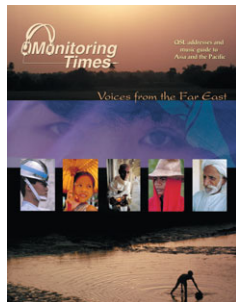
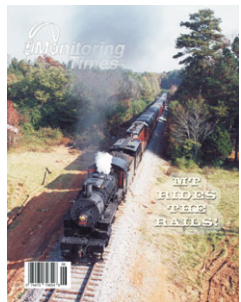
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“Midland 1 Listens” – Two Thumbs Up!

by Jock Elliott, MT Columnist

Every once in a while, one of the electronics companies comes up with what appears to be an extremely bright idea, and when that happens, it is always a pleasure to say: “Two thumbs up! Well done!”

In early January, 2003, Midland Radio Corporation issued a news release announcing a new initiative called *Midland 1 Listens*. It said in part: “*Midland 1 Listens* will adopt CB Radio Channel 1 (26.965 MHz) as well as Channel 1 (462.5625 MHz) on all FRS (Family Radio Service) and GMRS (General Mobile Radio Service) Two-Way Radios effective immediately for all types of ‘meet and greet’ contacts and travel assistance as well as emergency use.”

The purpose of the *Midland 1 Listens* initiative is that “Everyday CB and two-way radio users throughout the country in cars, SUVs, pick-up trucks, RV vehicles, and even those enjoying the great outdoors will be able to reach out and make contact with someone for help or conversation.” Midland intends to promote this concept nationwide in advertising, product packaging, in-store dealer displays and promotional materials. It will also enlist Midland dealers to monitor Ch. 1 on CB and FRS/GMRS and will undertake a substantial publicity campaign.

Now, at this point, I should ‘fess up: I had a hand in the creation of the *Midland 1 Listens* concept. Jesse Rotman from Midland phoned me to solicit my reaction to the *Midland 1 Listens* idea, which initially called for the monitoring of CB Ch. 1 only. I suggested adding FRS/GMRS channel 1; Rotman agreed, and the idea took off.

An idea whose time has come

Having said that, I think *Midland 1 Listens* is a darn good idea for three key reasons. First, there is a crying need for such an initiative. For more than six years, I have run a commuter assistance network on 2-meter ham radio in the Capital District of New York State. We average more than 1,000 calls for assistance a year. They range from personal injury automobile accidents to simple inquiries: “Can you tell me where to find a good place to eat?”

While it is true that in many parts of the country, you see fewer CB antennas on cars, CB remains a staple of communication between long haul truckers. In addition, many people are using FRS or GMRS ra-

dios on the road, primarily for communication between cars when two or more are traveling together. I think it would be tremendous if they were aware that there is a “calling” channel and that someone might be monitoring to help.

Second, CB Ch. 9 has been murdered by those who sought to protect it. When the FCC designated Ch. 9 as the official emergency and traveler’s assistance channel, certain national groups chose not to remember that it was also designated for traveler’s assistance. As a result, non-emergency travel related inquiries frequently were chased off Ch. 9. This produced an extremely quiet channel. Since nature abhors a vacuum, foreign DX stations quickly adopted Ch. 9 as a calling channel. The result is that now, on a day when 39 of 40 CB channels are seeing little traffic, Ch. 9 is buzzing like a bee’s nest with DXers. That means frequently Ch. 9 is useless for traveler’s assistance or emergencies simply because it is so hard to be heard.

Third, cell phones won’t do the job that *Midland 1 Listens* will. Many of my friends and relatives have cell phones, and they are great for person-to-person communications, but they have a couple of serious limitations. One is that they are not networked, so you can’t hear, say, truckers saying that there is a big wreck five miles ahead on the interstate. The second is that they are extremely awkward for traveler’s assistance. Suppose you are in a strange town, and you need to find a Ford dealership, a campground, or a place to eat. The authorities will take a very dim view if you dial 911 to ask.

The bottom line

Midland 1 Listens is a great idea, and it would terrific if other manufacturers would support the idea. Further, all of us can help. If you have a CB rig at home or in your vehicle, tune it to Ch. 1, squelch out the noise, and be ready to respond if someone asks. If you have a scanner, make sure FRS/GMRS Ch. 1 is one of the frequencies you regularly monitor. If you hear someone asking for help, you can fire up your FRS or GMRS two-way and get back to them. You never know when you can offer someone a helping hand. And when you do, I guarantee you’ll stand a little taller for the rest of the day.

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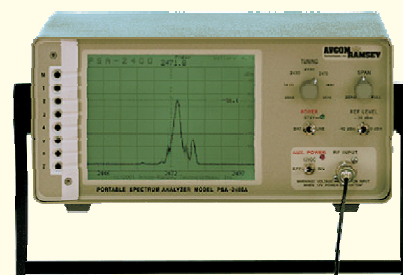
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